Technical Report HL-93-15
1993

US Army Corps
of Engineers
Waterways Experiment
Station

HYDRAULICS LAB COPY

Ship Navigation Simulation Study, Lorain Harbor, Lorain, Ohio

Volume II: Appendices A and B

by Michelle M. Thevenot, Carl J. Huval, Larry L. Daggett
Hydraulics Laboratory

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Prepared for U.S. Army Engineer District, Buffalo

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Final report

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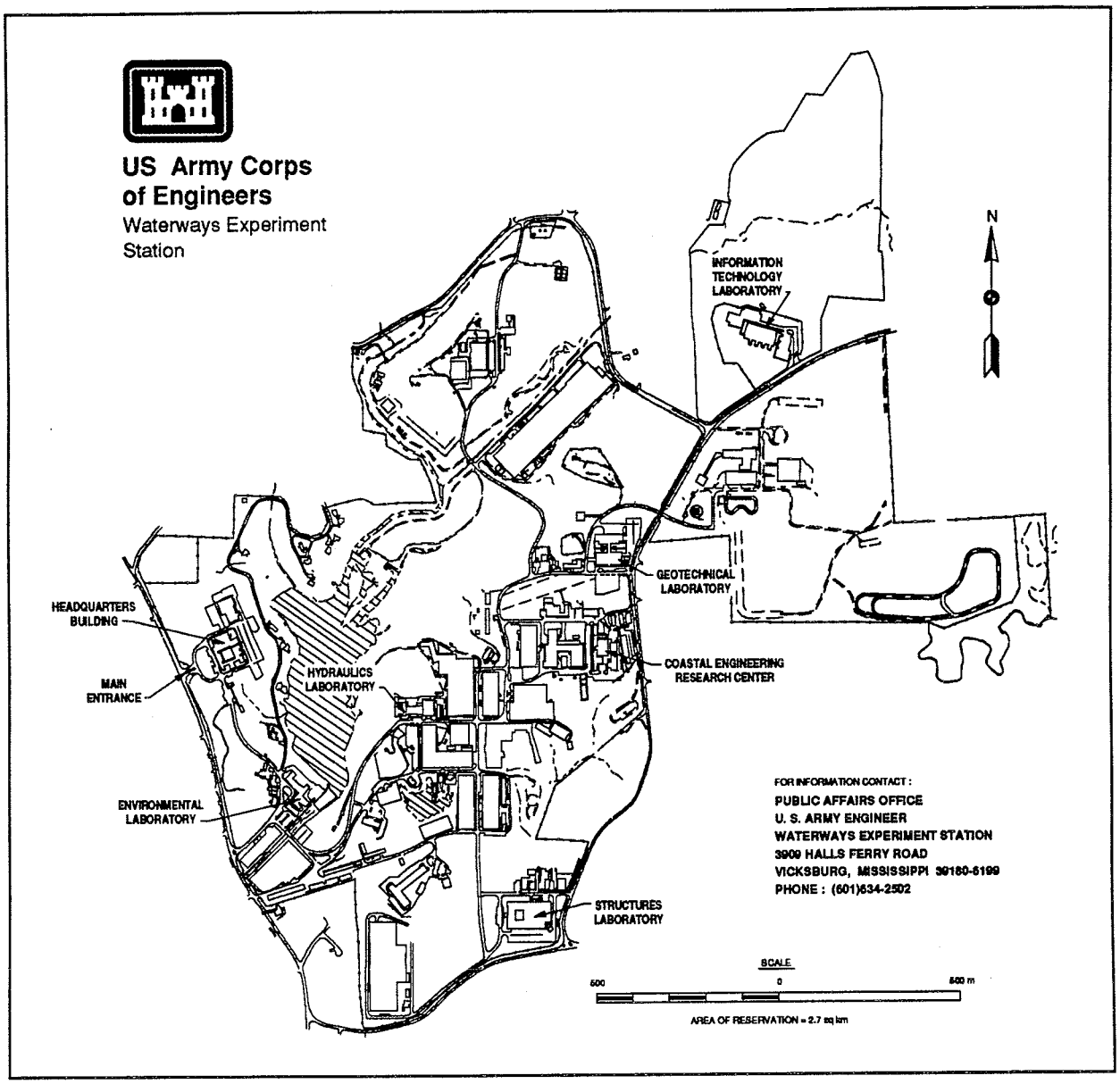
Buffalo, NY 14207-3199



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APPENDIX A: SHIPMASTER QUESTIONNARIE AND COMMENTS

LORAIN HARBOR SHIP SIMULATION PROJECT
PILOT RATING

PILOT:_____ DATE:_____
RUN CODE:_____ FILE NAME:_____
START TIME:_____ END TIME:_____

Have you ever piloted a vessel with a stern thruster?_____

The purpose of this questionnaire is to document your evaluation of the simulator run you have just completed. Please rate the run relative to your overall experience in handling ships in this reach. Feel free to make any specific comments you believe will be helpful in interpreting your ratings. You may wish to make notes on the trackline plot presented to you following the run.

	Very Simple										Very difficult
Area A	0	1	2	3	4	5	6	7	8	9	10
Area B	0	1	2	3	4	5	6	7	8	9	10
Area C	0	1	2	3	4	5	6	7	8	9	10
Area D	0	1	2	3	4	5	6	7	8	9	10
Area 1	0	1	2	3	4	5	6	7	8	9	10
Area 2	0	1	2	3	4	5	6	7	8	9	10

DIFFICULTY OF THE RUN

	Little										All of it
Area A	0	1	2	3	4	5	6	7	8	9	10
Area B	0	1	2	3	4	5	6	7	8	9	10
Area C	0	1	2	3	4	5	6	7	8	9	10
Area D	0	1	2	3	4	5	6	7	8	9	10
Area 1	0	1	2	3	4	5	6	7	8	9	10
Area 2	0	1	2	3	4	5	6	7	8	9	10

MANEUVERABILITY

	Little										Tremendous
Area A	0	1	2	3	4	5	6	7	8	9	10
Area B	0	1	2	3	4	5	6	7	8	9	10
Area C	0	1	2	3	4	5	6	7	8	9	10
Area D	0	1	2	3	4	5	6	7	8	9	10
Area 1	0	1	2	3	4	5	6	7	8	9	10
Area 2	0	1	2	3	4	5	6	7	8	9	10

DANGER OF GROUNDING

	Little										Tremendous
Area A	0	1	2	3	4	5	6	7	8	9	10
Area B	0	1	2	3	4	5	6	7	8	9	10
Area C	0	1	2	3	4	5	6	7	8	9	10
Area D	0	1	2	3	4	5	6	7	8	9	10
Area 1	0	1	2	3	4	5	6	7	8	9	10
Area 2	0	1	2	3	4	5	6	7	8	9	10

AMOUNT OF BANK EFFECTS

	Bad										Very good
Area A	0	1	2	3	4	5	6	7	8	9	10
Area B	0	1	2	3	4	5	6	7	8	9	10
Area C	0	1	2	3	4	5	6	7	8	9	10
Area D	0	1	2	3	4	5	6	7	8	9	10
Area 1	0	1	2	3	4	5	6	7	8	9	10
Area 2	0	1	2	3	4	5	6	7	8	9	10

AMOUNT OF THRUSTER USED

LORAIN HARBOR SHIP SIMULATION STUDY

The purpose of this questionnaire is to get your final thoughts on the simulation study in which you have just participated. Please base your answers on the simulation runs.

1. Do you feel that the way in which the thrusters were used would damage the vessels docked along the banks or cause extensive erosion?

2. On the channel provided, show the cuts you would implement assuming a stern thruster is added to the ship. Prioritize them by numbering from most important through least important.

3. Have the bank effects changed? If so, show where (on the channel provided). State whether they were helpful or hindering.

4. The simulator provides (circle one):

a) less information than
b) the same information
c) more information than

available aboard the ship.

5. On a scale from 0 to 10 (10 being excellent), what is your overall opinion of the simulator and the Lorain Harbor simulation.

6. Do you have any suggestions for improving the simulation?

7. Please use the space provided for any additional comments.

LORAIN HARBOR SHIP SIMULATION STUDY

The purpose of this questionnaire is to get your final thoughts on the simulation study in which you have just participated. Please base your answers on the simulation runs.

1. Do you feel that the way in which the thrusters were used would damage the vessels docked along the banks or cause extensive erosion?

Little damage to other vessels (possibly hazard for small craft). Could create some erosion as all thrusters will.

2. On the channel provided, show the cuts you would implement assuming a stern thruster is added to the ship. Prioritize them by numbering from most important through least important.

Done.

3. Have the bank effects changed? If so, show where (on the channel provided). State whether they were helpful or hindering.

No effects noticed.

4. The simulator provides (circle one):

a) less information than
b) the same information
c) more information than
available aboard the ship.

5. On a scale from 0 to 10 (10 being excellent), what is your overall opinion of the simulator and the Lorain Harbor simulation.

8

6. Do you have any suggestions for improving the simulation?

Longer period of time for Pilot to familiarizes himself @ characteristics of equipment.

7. Please use the space provided for any additional comments.

LORAIN HARBOR SHIP SIMULATION STUDY
PILOT RATING

PILOT:_____ DATE:_____
RUN CODE:_____ FILE NAME:_____
START TIME:_____ END TIME:_____

The purpose of this questionnaire is to document is to your evaluation of the simulation run just completed. Please rate the run relative to your overall experience in handling ships in this reach. Feel free to make any specific comments you believe will be helpful in interpreting your ratings. You may wish to make notes on the trackline plot presented to you following the run.

Rate the difficulty of the run?

very simple										very difficult
0	1	2	3	4	5	6	7	8	9	10

What was the likelihood of grounding?

none										often
0	1	2	3	4	5	6	7	8	9	10

Rate the controllability of the ship in the following areas?

1. Area B

very easy										very difficult
0	1	2	3	4	5	6	7	8	9	10

2. Area C

very easy										very difficult
0	1	2	3	4	5	6	7	8	9	10

3. Area D

very easy										very difficult
0	1	2	3	4	5	6	7	8	9	10

4. Turning Basin

very easy — very difficult

0 1 2 3 4 5 6 7 8 9 10

Rate the damage you feel would have been caused to docked ships due to the wake of the ship or the thruster jets.

no damage — unacceptable amounts of damage

0 1 2 3 4 5 6 7 8 9 10

How accurate were the simulated bank effects.

very unrealistic — very realistic

0 1 2 3 4 5 6 7 8 9 10

How accurate was the behavior of the ship.

very inaccurate — very accurate

0 1 2 3 4 5 6 7 8 9 10

Please feel free to make comments concerning the simulator run you have just completed.

LORAIN HARBOR SHIP SIMULATION STUDY
FINAL QUESTIONNAIRE

The purpose of this questionnaire is to document your final thoughts on the proposed bank cuts to the Black River in Lorain, Ohio.

With the consideration that initial and maintenance dredging costs are major factors in project viability, what channel cuts would you recommend in the following areas? Please specify the size. Also, give the priority of the cut in each area.

1. **Area B**

2. **Area C**

3. **Area D**

4. **Turning Basin**

5. **Do you feel that the way in which the thrusters were used would cause extensive bank erosion? Specify where.**

6. **Do you have any suggestions for improving the simulator procedure in general?**

7. **Overall how do you rate the realism of the simulator?**

LORAIN HARBOR SHIP SIMULATION STUDY
FINAL QUESTIONNAIRE

The purpose of this questionnaire is to document your final thoughts on the proposed bank cuts to the Black River in Lorain, Ohio.

With the consideration that initial and maintenance dredging costs are major factors in project viability, what channel cuts would you recommend in the following areas? Please specify the size. Also, give the priority of the cut in each area.

1. **Area B**

The proposed cut in Area "B" in Plan #1 would be helpful, need not be large as Plan #2 - Priority #3.

2. **Area C**

The propose cut in Area C would be most helpful. The cut in Plan #1 would be all that is needed. Need not Plan #2.

3. **Area D**

The cut in Plan 2 would be of some help. Not a high Priority Area.

4. **Turning Basin**

The propose cut at the turn basin would be very helpful Plan #1
Priority #2 - need not go to Plan 2.

Priority #4 would be the corner area across from the old ship yard dry docks near Erie Ave.

5. Do you feel that the way in which the thrusters were used would cause extensive bank erosion? Specify where.

No.

6. Do you have any suggestions for improving the simulator procedure in general?

The speed for the RPM in the River, with the hard turns, may be a little fast.

7. Overall how do you rate the realism of the simulator?

Good.

LORAIN HARBOR SHIP SIMULATION STUDY
FINAL QUESTIONNAIRE

The purpose of this questionnaire is to document your final thoughts on the proposed bank cuts to the Black River in Lorain, Ohio.

With the consideration that initial and maintenance dredging costs are major factors in project viability, what channel cuts would you recommend in the following areas? Please specify the size. Also, give the priority of the cut in each area.

1. **Area B**

Cut 80 ft

2. **Area C**

Cut 150 ft

3. **Area D**

Cut 50 ft

4. **Turning Basin**

Cut 150 ft

5. Do you feel that the way in which the thrusters were used would cause extensive bank erosion? Specify where.

Yes Area B and A and Turning Basin

6. Do you have any suggestions for improving the simulator procedure in general?

No.

7. Overall how do you rate the realism of the simulator?

Very accurate.

LORAIN HARBOR SHIP SIMULATION STUDY
FINAL QUESTIONNAIRE

The purpose of this questionnaire is to document your final thoughts on the proposed bank cuts to the Black River in Lorain, Ohio.

With the consideration that initial and maintenance dredging costs are major factors in project viability, what channel cuts would you recommend in the following areas? Please specify the size. Also, give the priority of the cut in each area.

1. **Area B**

Cut between 1 + 2 proposal.

2. **Area C**

Cut between 1 + 2 proposal.
Most important.

3. **Area D**

50 ft.

4. **Turning Basin**

Take corner off.

5. Do you feel that the way in which the thrusters were used would cause extensive bank erosion? Specify where.

No.

6. Do you have any suggestions for improving the simulator procedure in general?

No.

7. Overall how do you rate the realism of the simulator?

Very good.

LORAIN HARBOR SHIP SIMULATION STUDY
FINAL QUESTIONNAIRE

The purpose of this questionnaire is to document your final thoughts on the proposed bank cuts to the Black River in Lorain, Ohio.

With the consideration that initial and maintenance dredging costs are major factors in project viability, what channel cuts would you recommend in the following areas? Please specify the size. Also, give the priority of the cut in each area.

1. **Area B**

WNW corner removal of western bank would aid in vessels not required to use thrusters in marina area.
Priority #3

2. **Area C**

This would be a priority #1 of all the areas. Cut as much as the last run (FDW 242) Re: When vessel, single screw, backing does not help make the turn.

3. **Area D**

Removal of west corner would aid in turn if vessels are using the south dock
Priority #4

4. **Turning Basin**

Remove corner, north pt, also widen and deepen notch.
RE: vessel turning in wind and current would be able to handle the conditions easier.
Priority #2 (also relieves the master on room for the stern to swing.)

5. Do you feel that the way in which the thrusters were used would cause extensive bank erosion? Specify where.

Yes, in any area that is not lined with rip-rap-providing the turns are left as is. If all turns are widened thruster wash should not do too much damage. There is not that much damage in Rouge River.

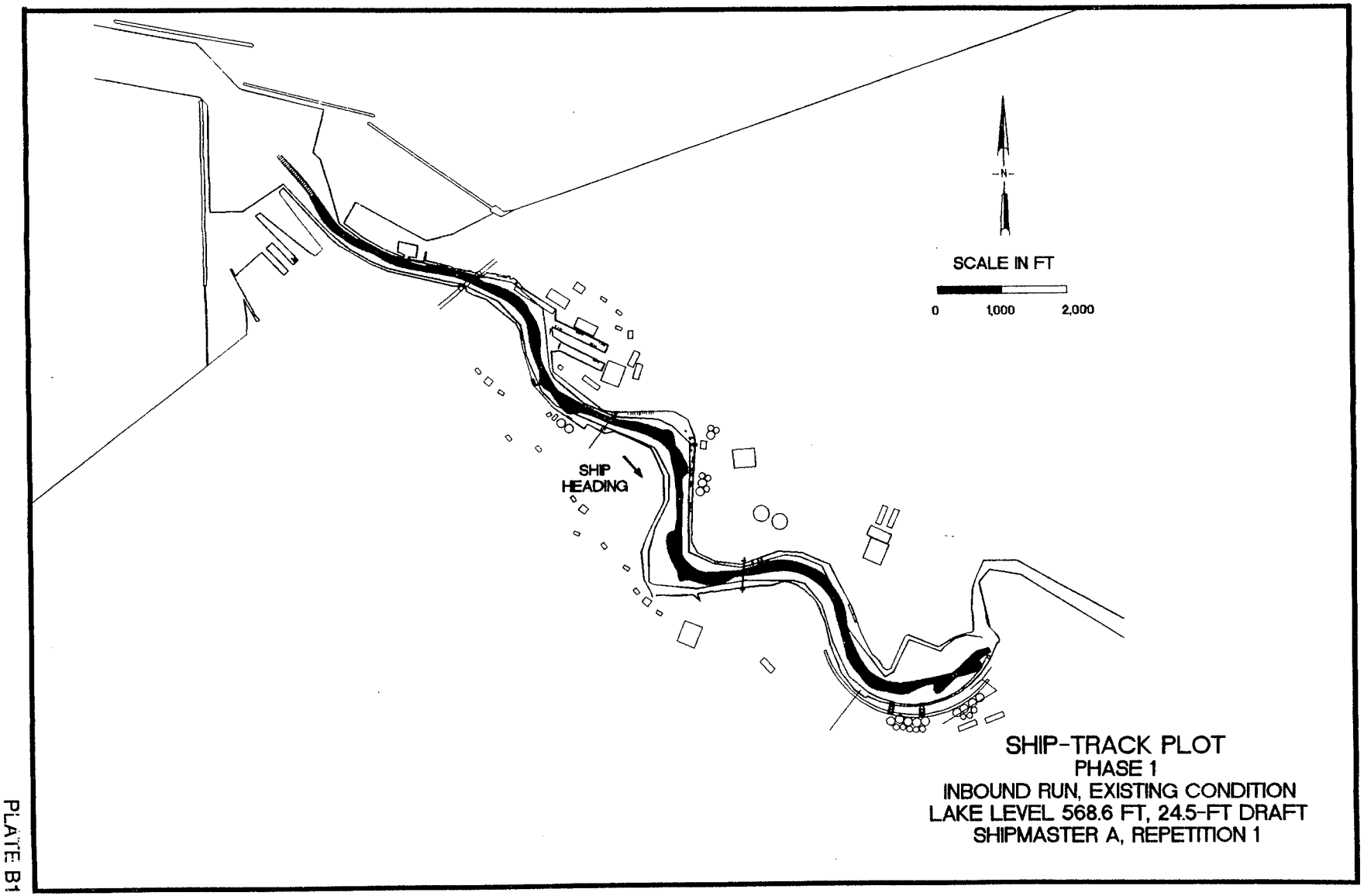
6. Do you have any suggestions for improving the simulator procedure in general?

None, as is, the system is very realistic to handling a vessel.

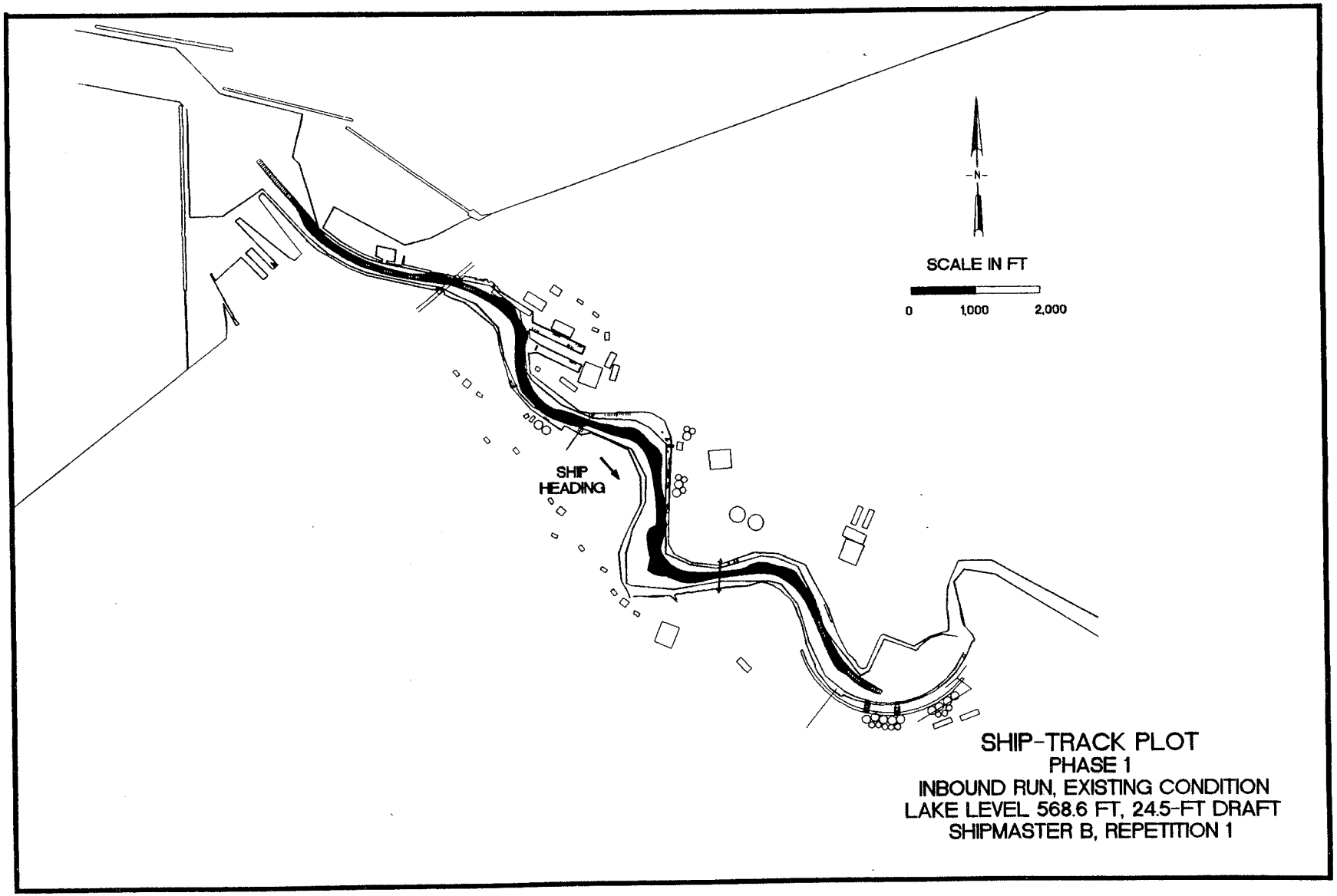
7. Overall how do you rate the realism of the simulator?

Very good.

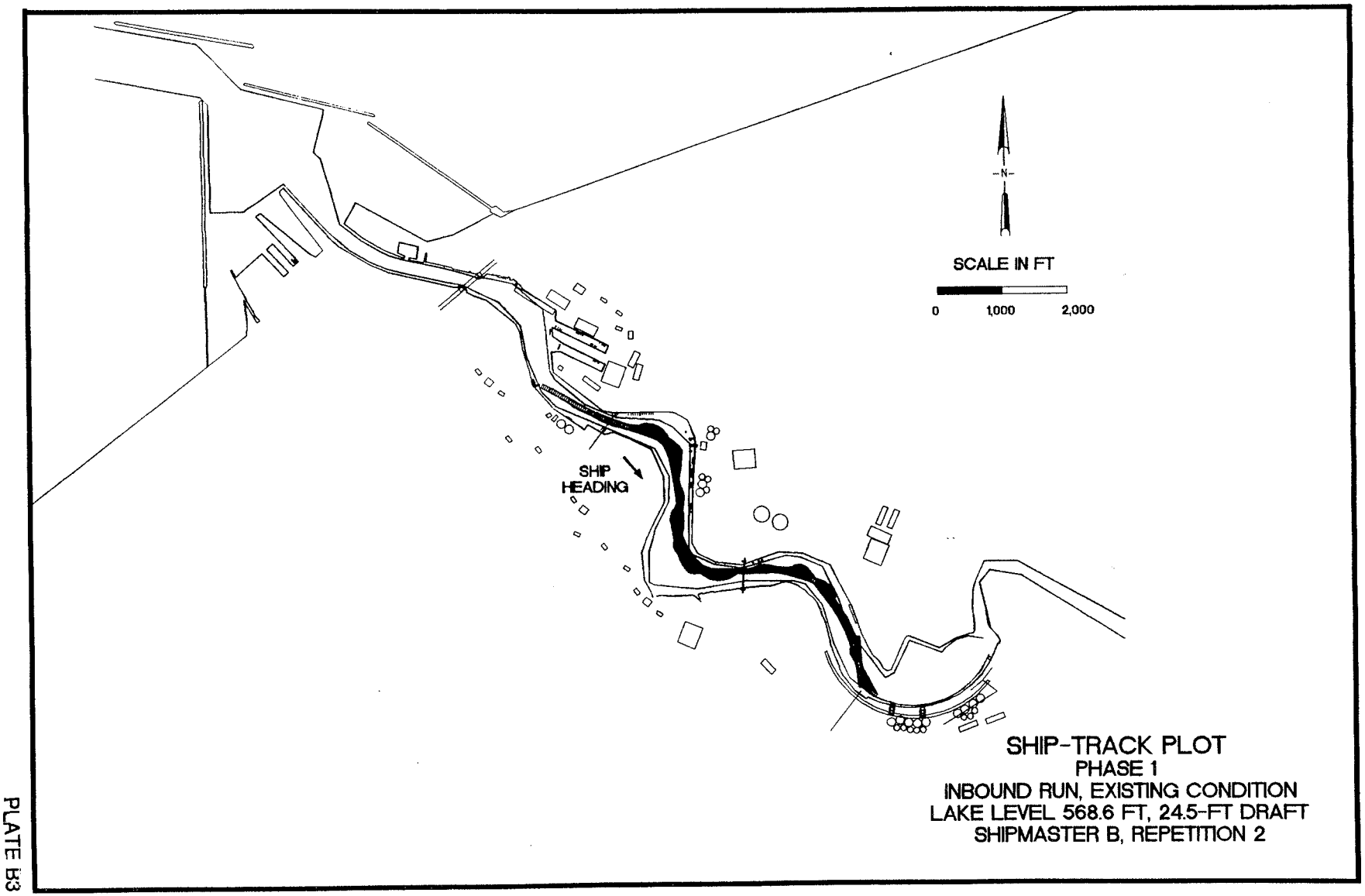
APPENDIX B: SHIP TRACK PLOTS



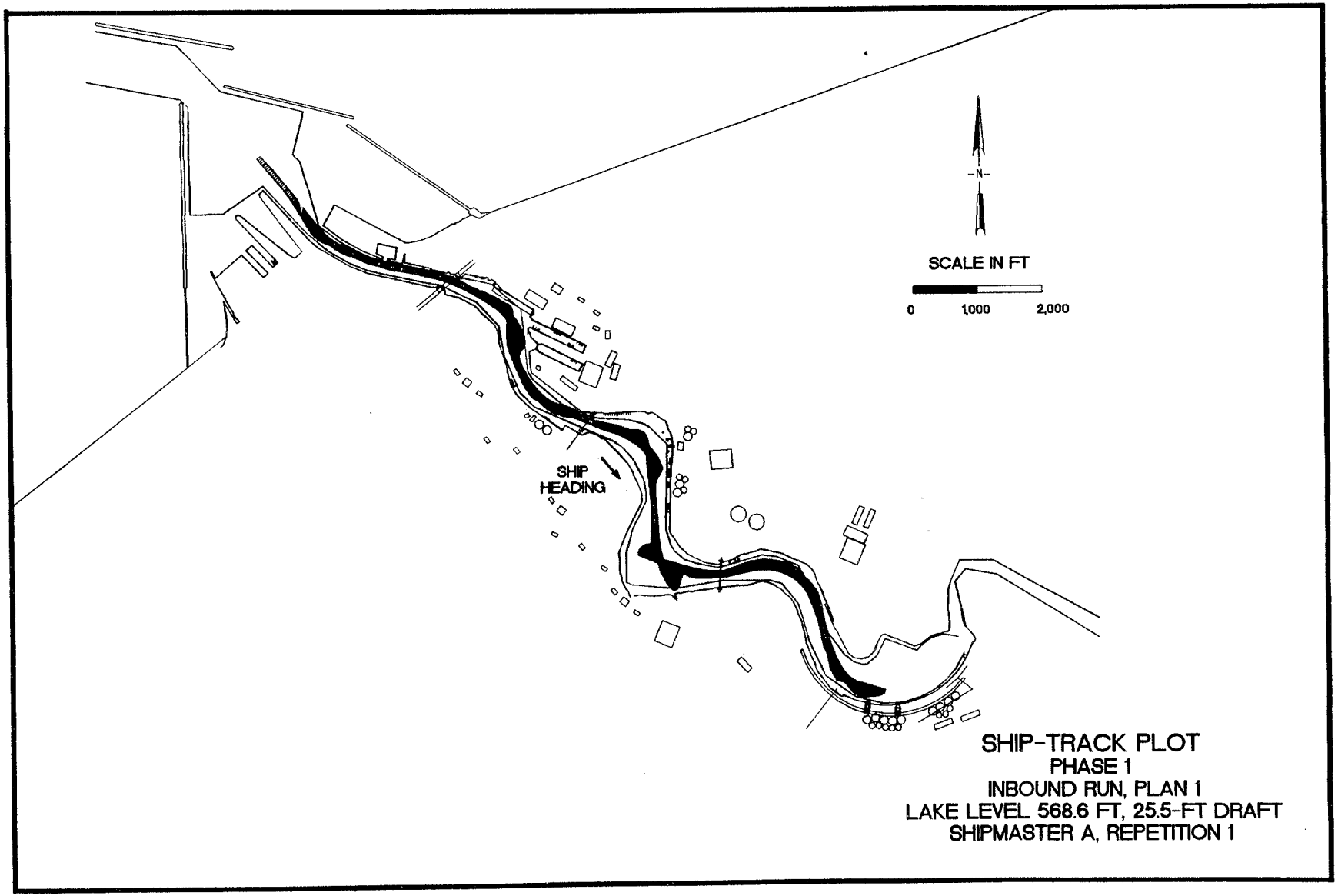
SHIP-TRACK PLOT
PHASE 1
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 24.5-FT DRAFT
SHIPMASTER A, REPETITION 1



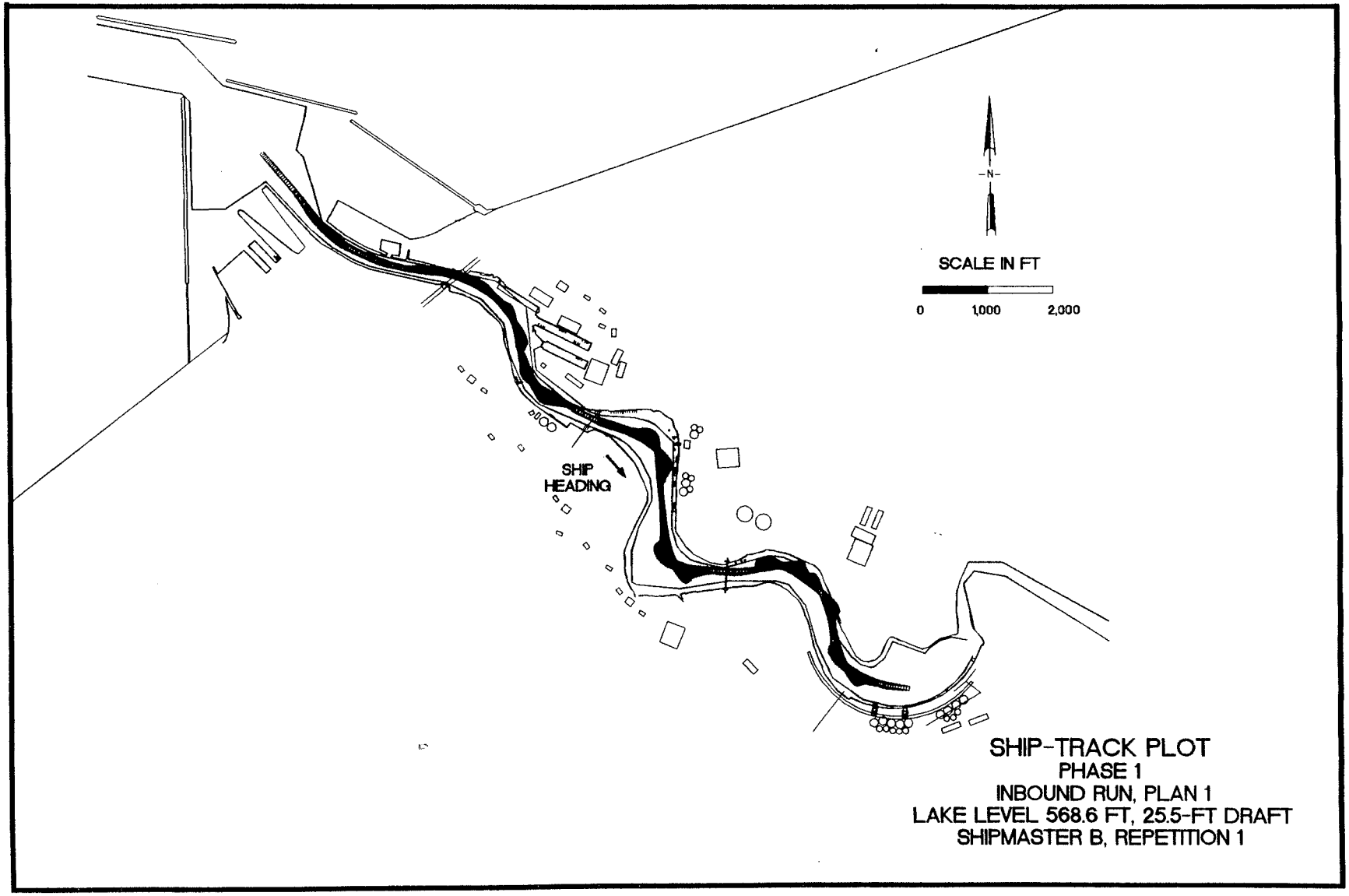
SHIP-TRACK PLOT
PHASE 1
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 24.5-FT DRAFT
SHIPMASTER B, REPETITION 1



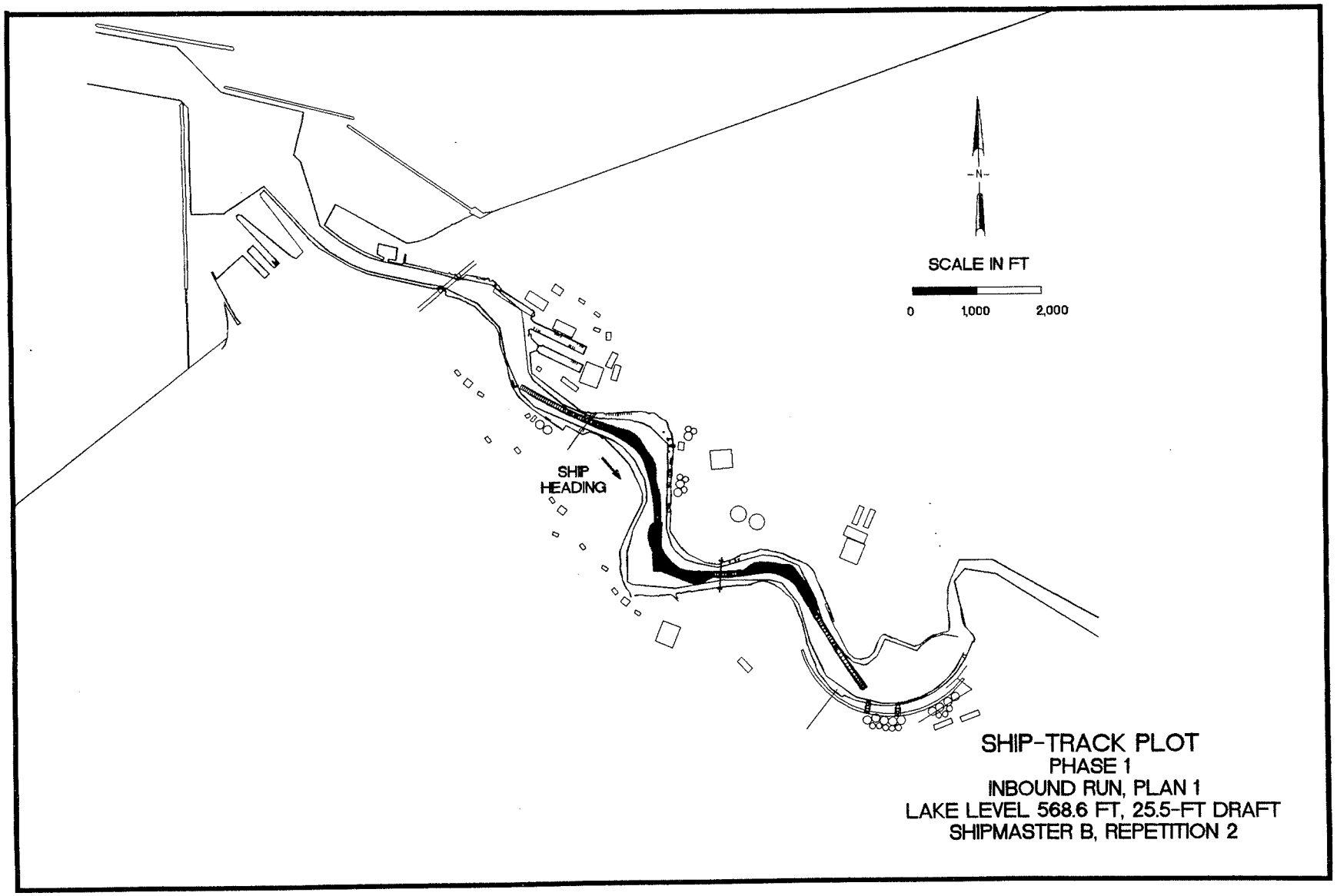
SHIP-TRACK PLOT
PHASE 1
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 24.5-FT DRAFT
SHIPMASTER B, REPETITION 2



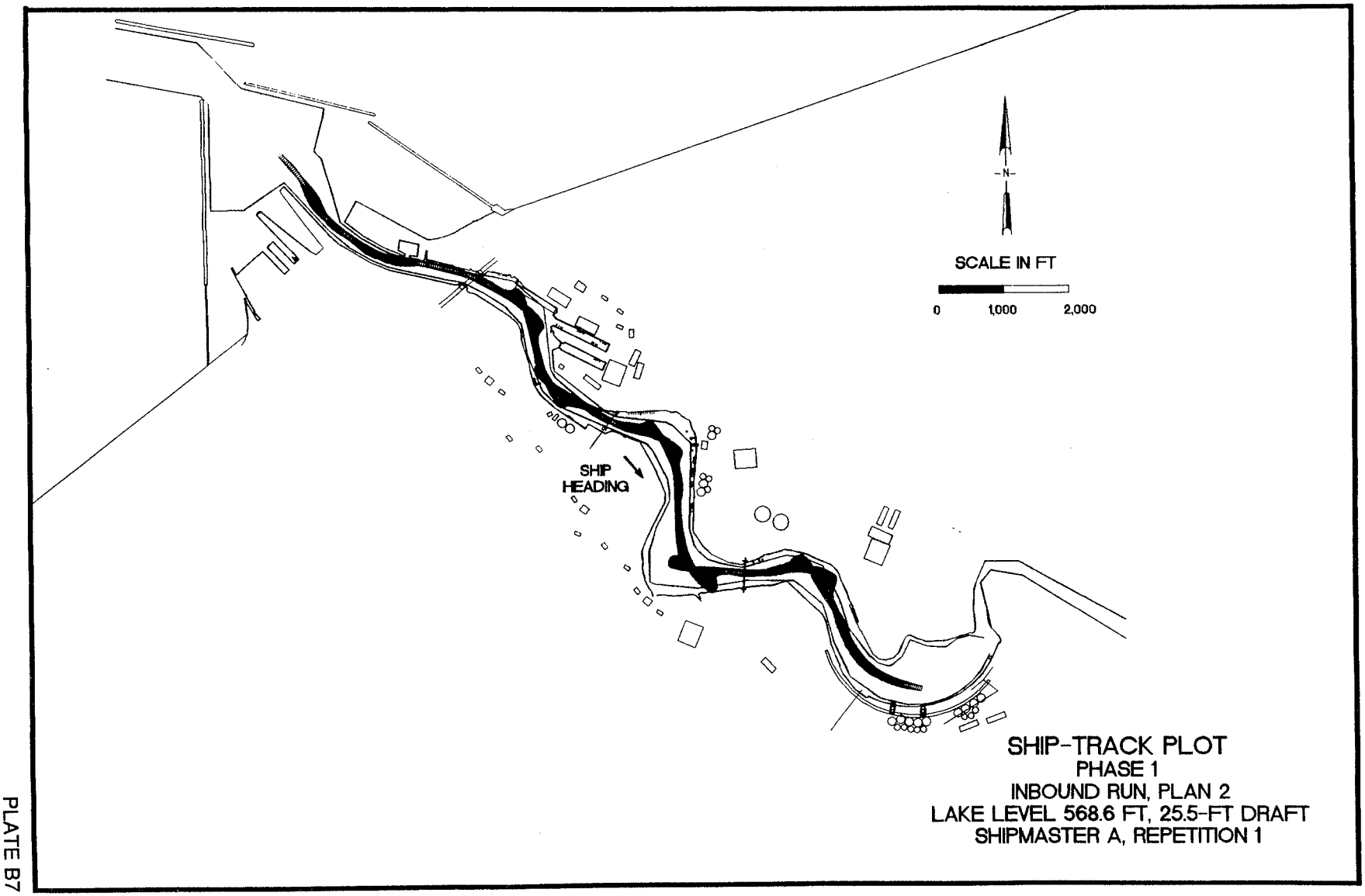
SHIP-TRACK PLOT
PHASE 1
INBOUND RUN, PLAN 1
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER A, REPETITION 1



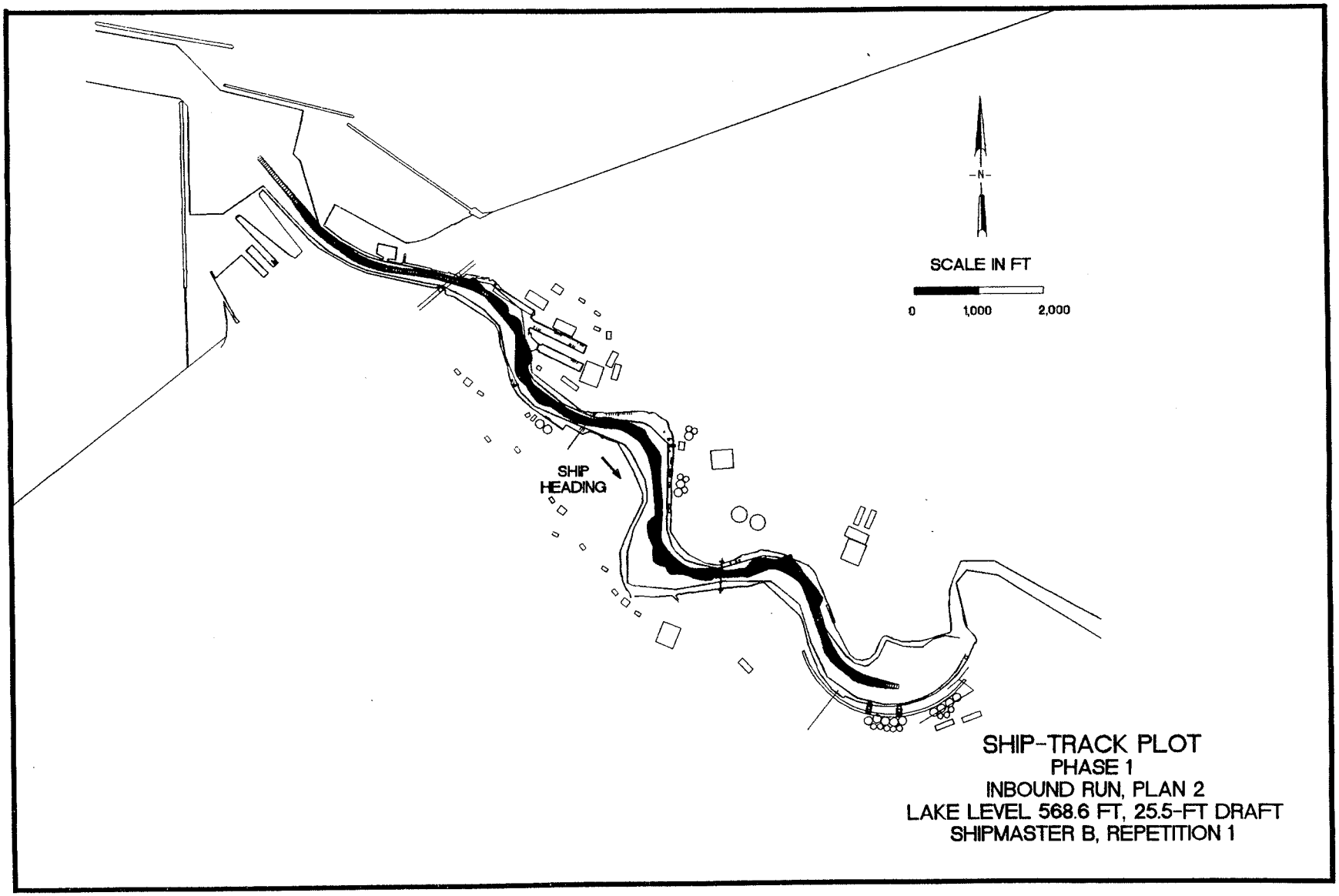
SHIP-TRACK PLOT
PHASE 1
INBOUND RUN, PLAN 1
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER B, REPETITION 1



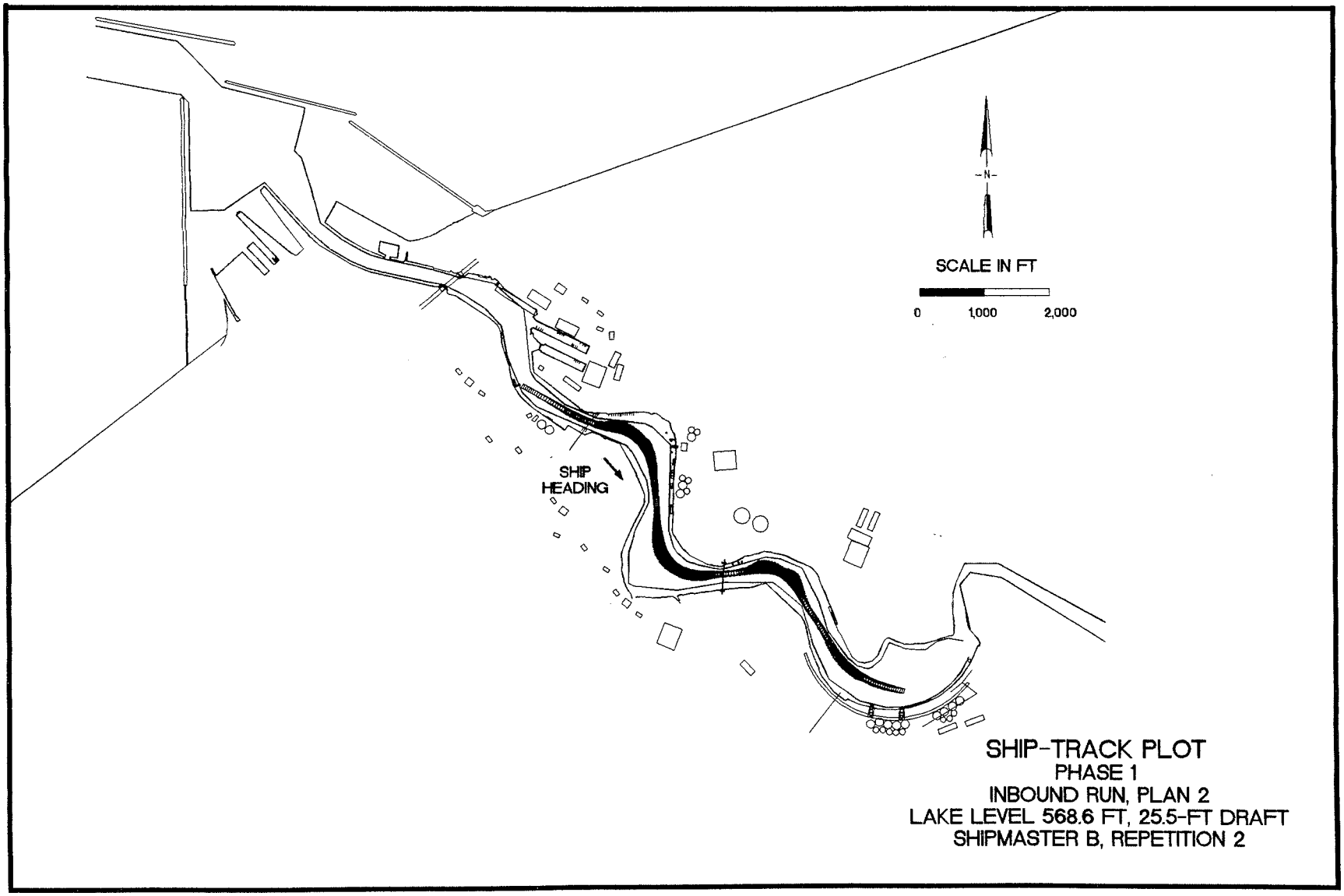
SHIP-TRACK PLOT
PHASE 1
INBOUND RUN, PLAN 1
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER B, REPETITION 2



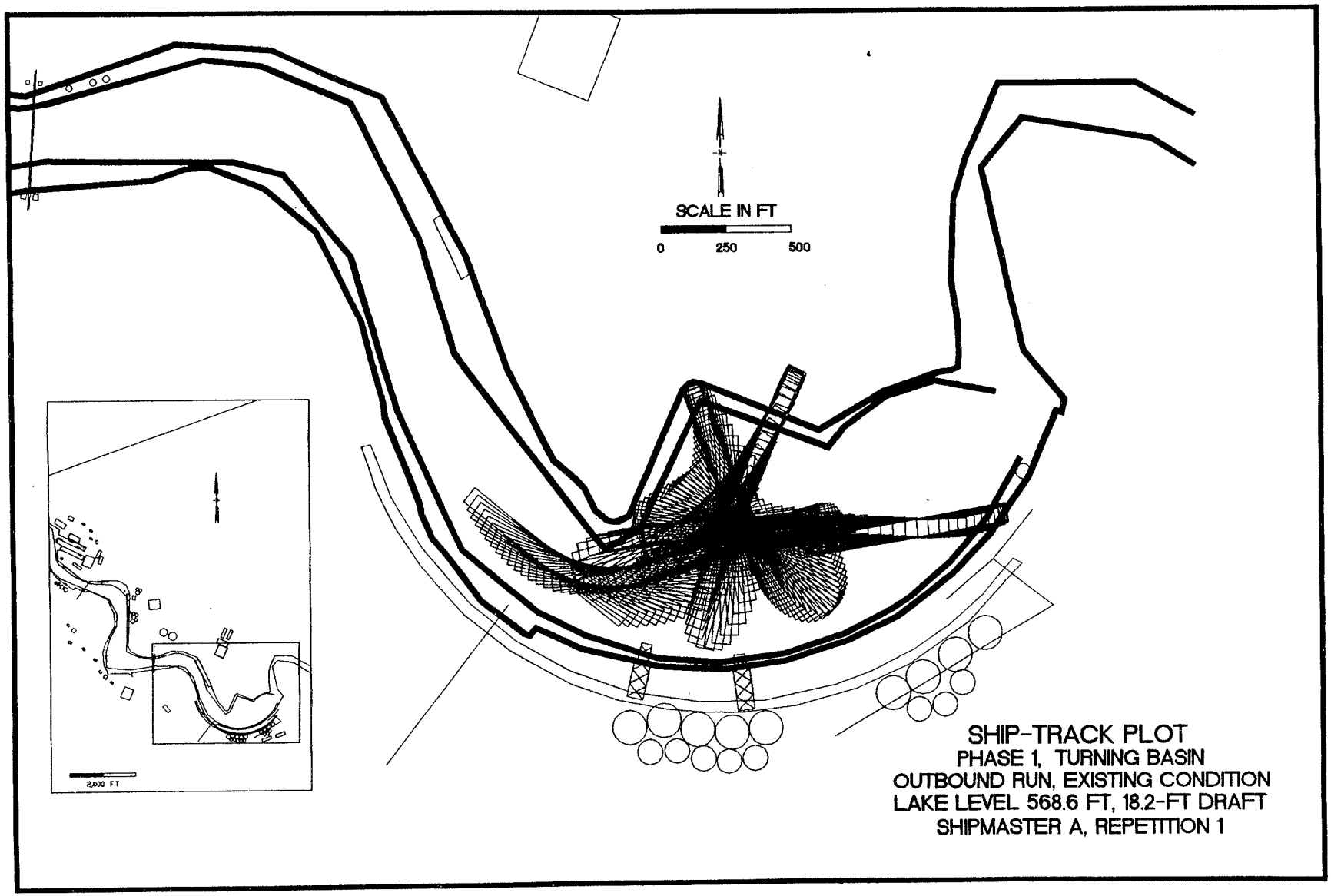
SHIP-TRACK PLOT
PHASE 1
INBOUND RUN, PLAN 2
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER A, REPETITION 1



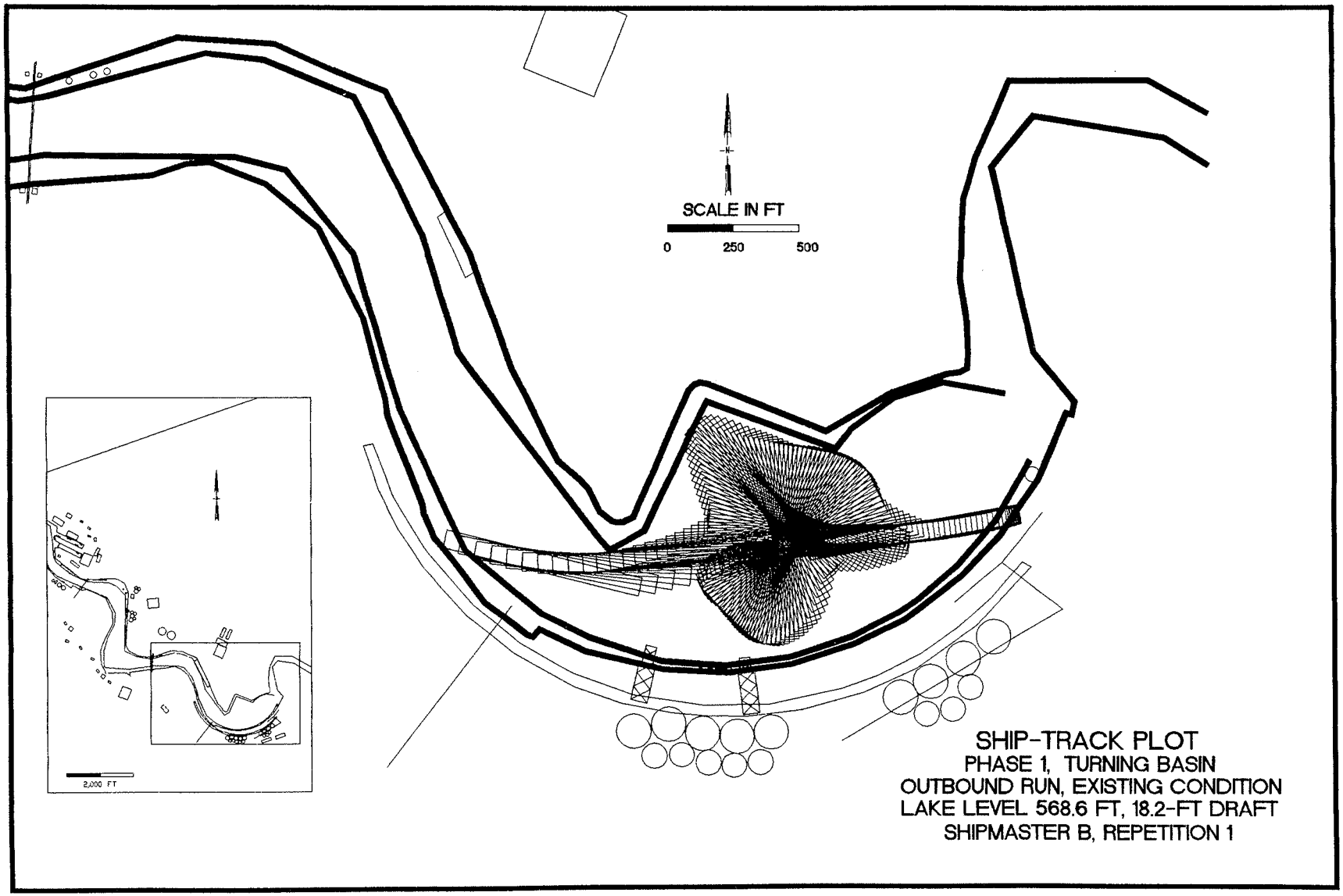
SHIP-TRACK PLOT
PHASE 1
INBOUND RUN, PLAN 2
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER B, REPETITION 1



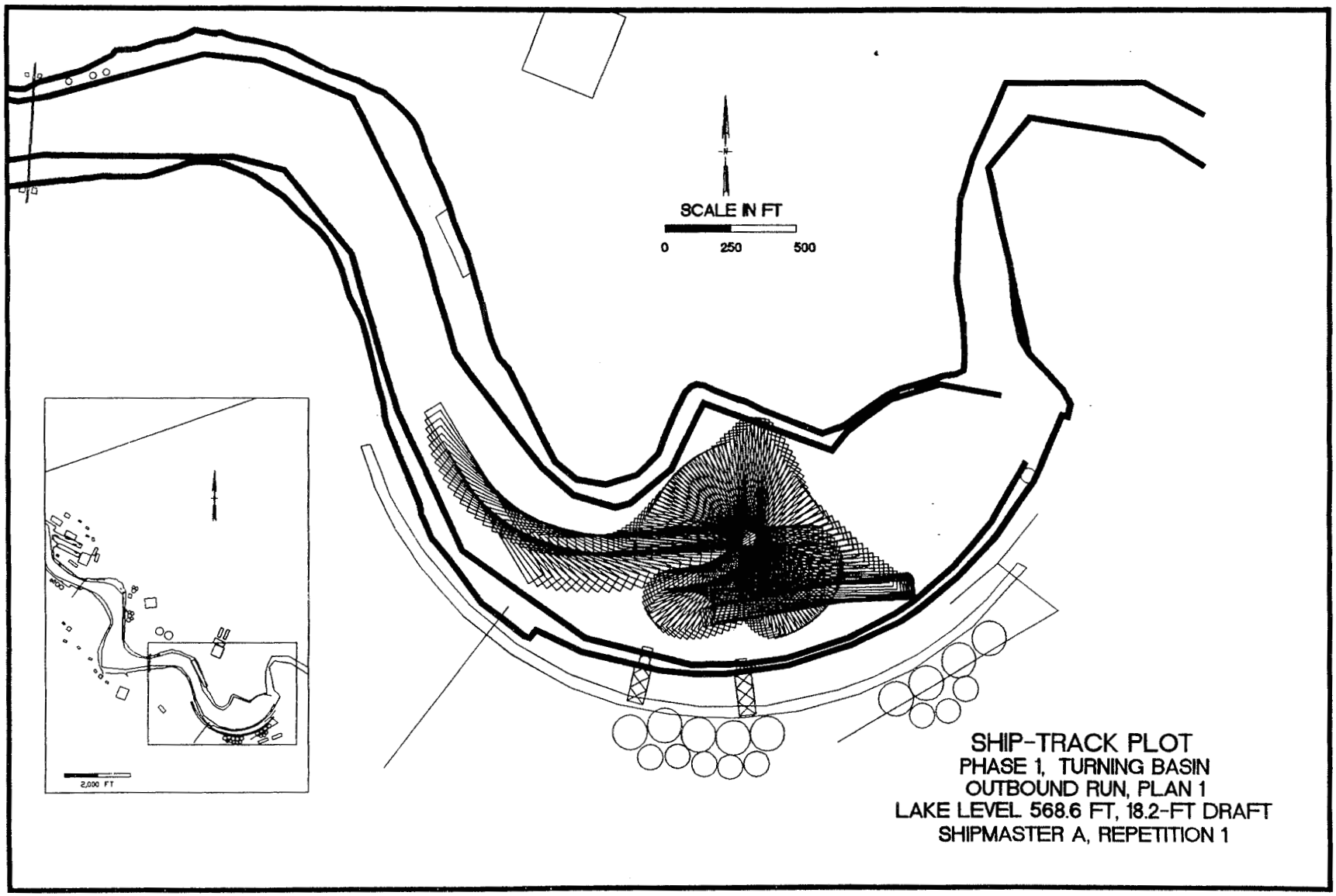
SHIP-TRACK PLOT
PHASE 1
INBOUND RUN, PLAN 2
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER B, REPETITION 2



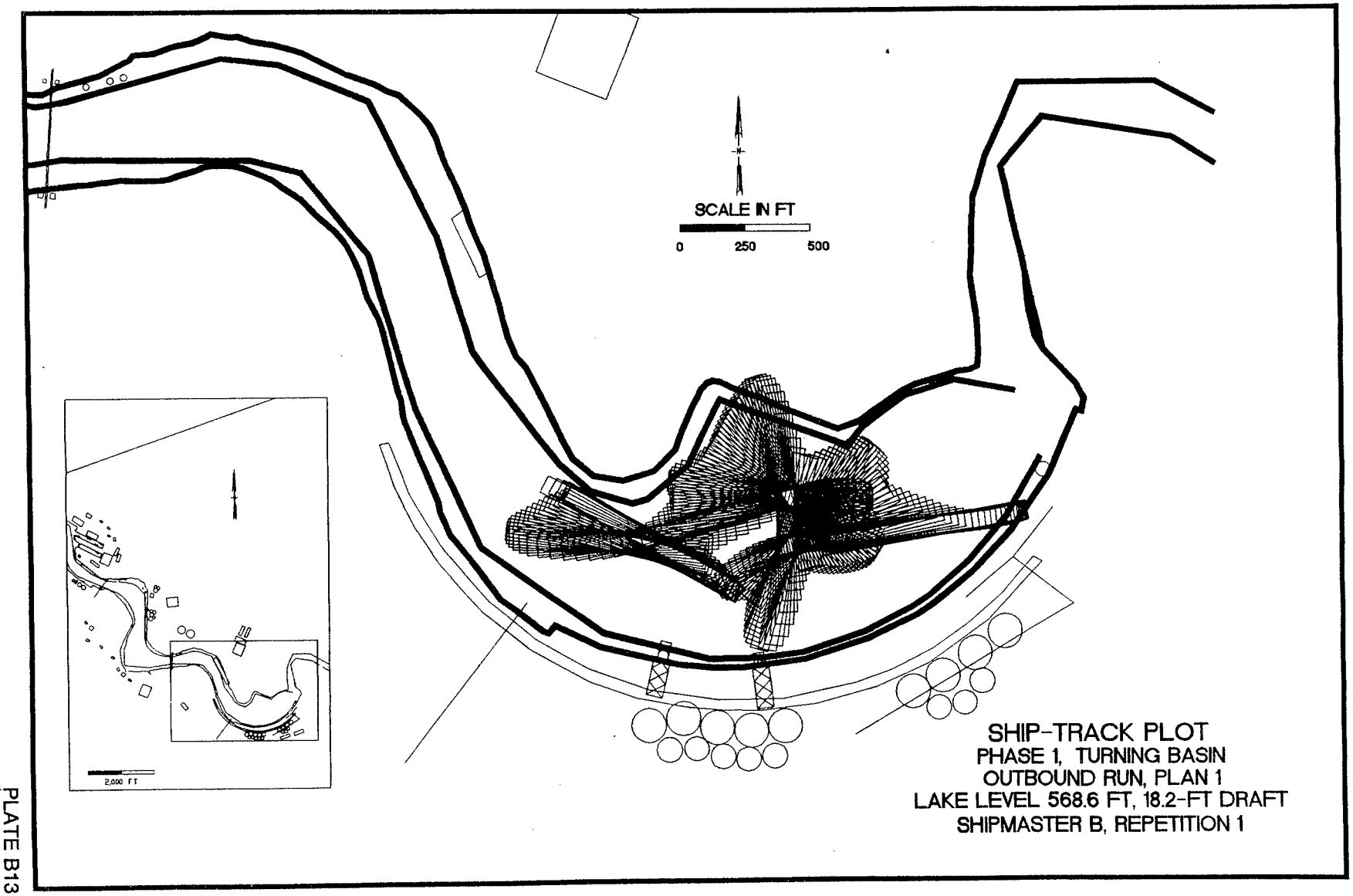
SHIP-TRACK PLOT
PHASE 1, TURNING BASIN
OUTBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER A, REPETITION 1



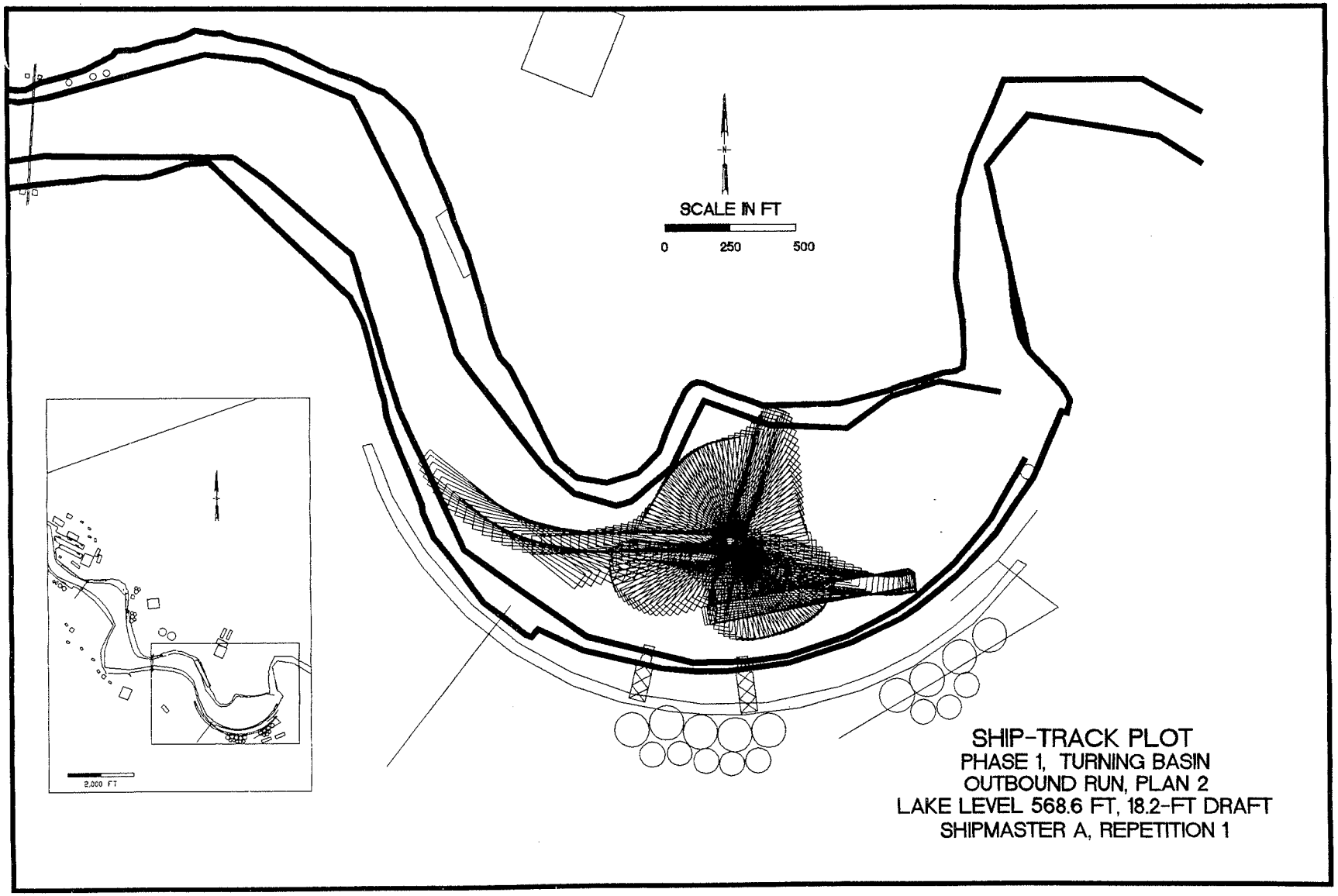
SHIP-TRACK PLOT
PHASE 1, TURNING BASIN
OUTBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER B, REPETITION 1



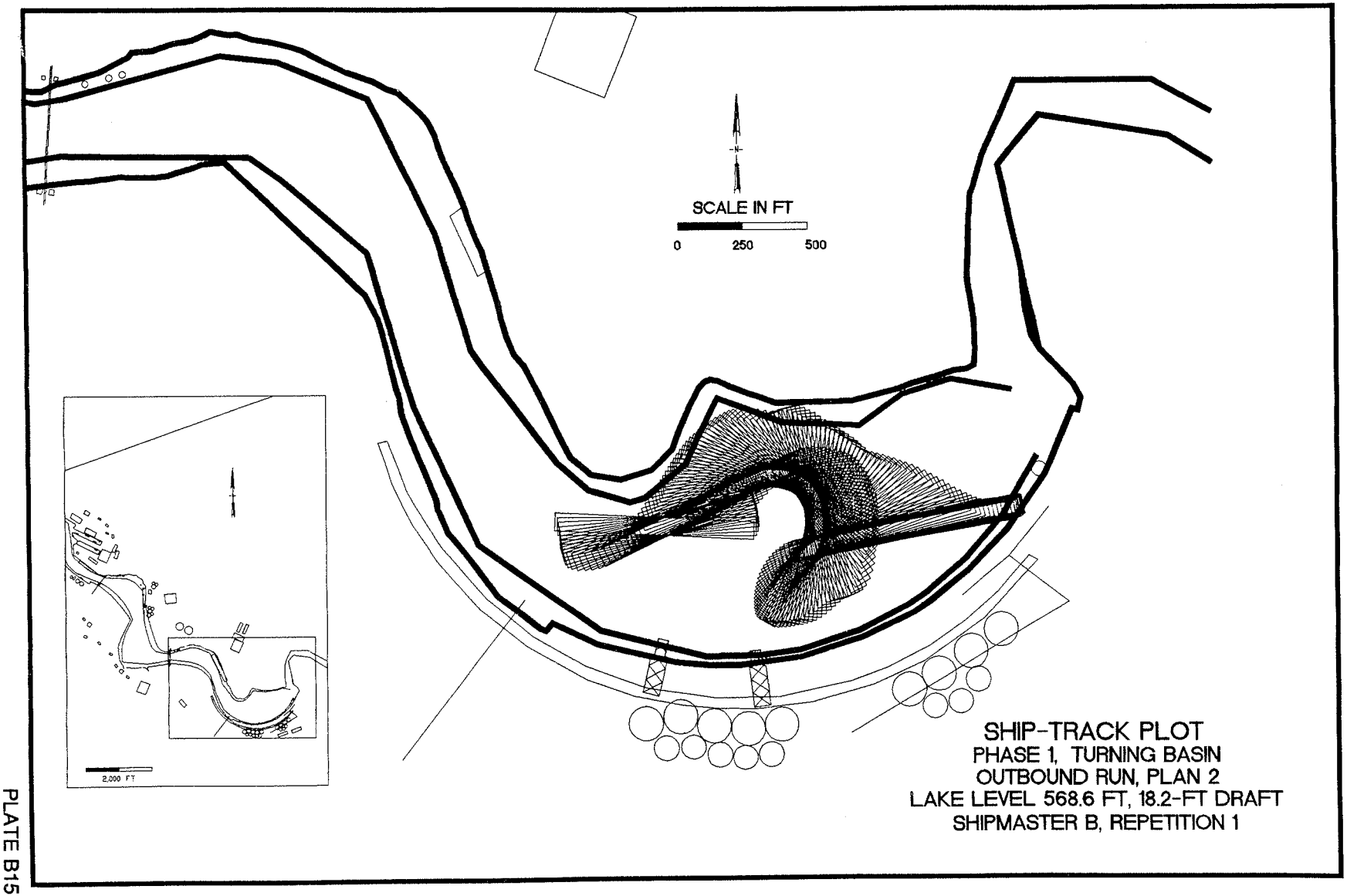
SHIP-TRACK PLOT
PHASE 1, TURNING BASIN
OUTBOUND RUN, PLAN 1
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER A, REPETITION 1



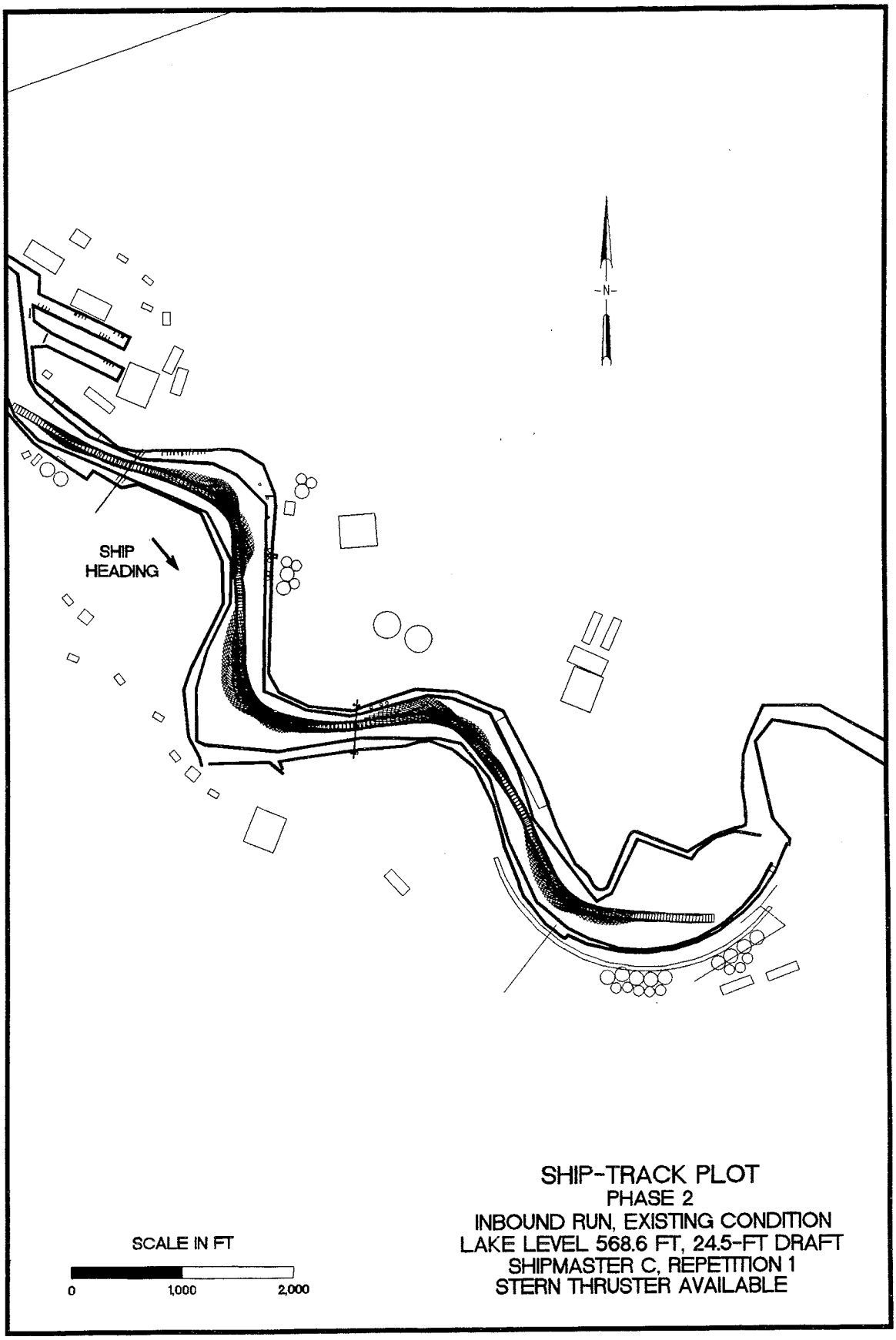
SHIP-TRACK PLOT
PHASE 1, TURNING BASIN
OUTBOUND RUN, PLAN 1
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER B, REPETITION 1



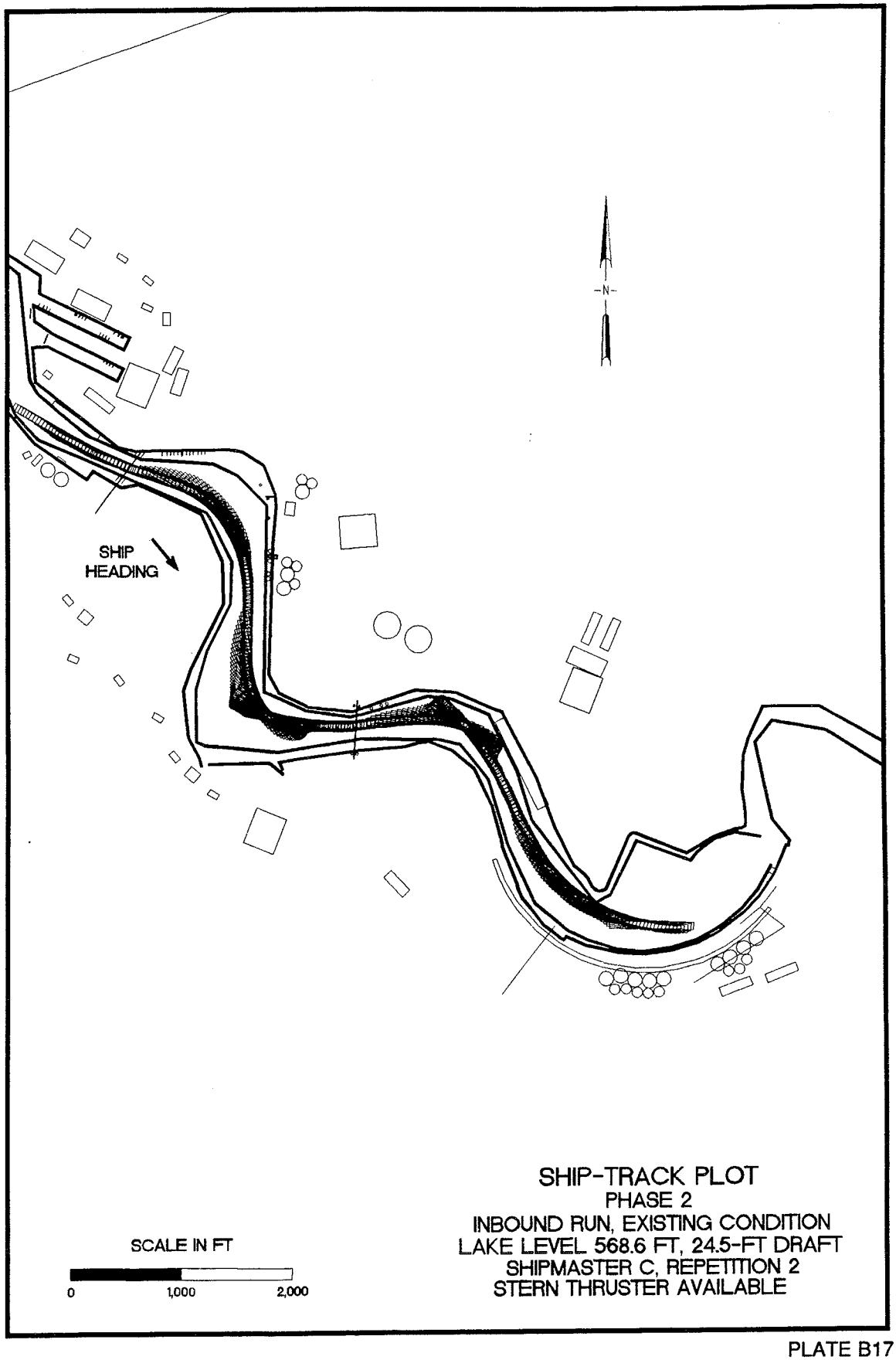
SHIP-TRACK PLOT
PHASE 1, TURNING BASIN
OUTBOUND RUN, PLAN 2
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER A, REPETITION 1



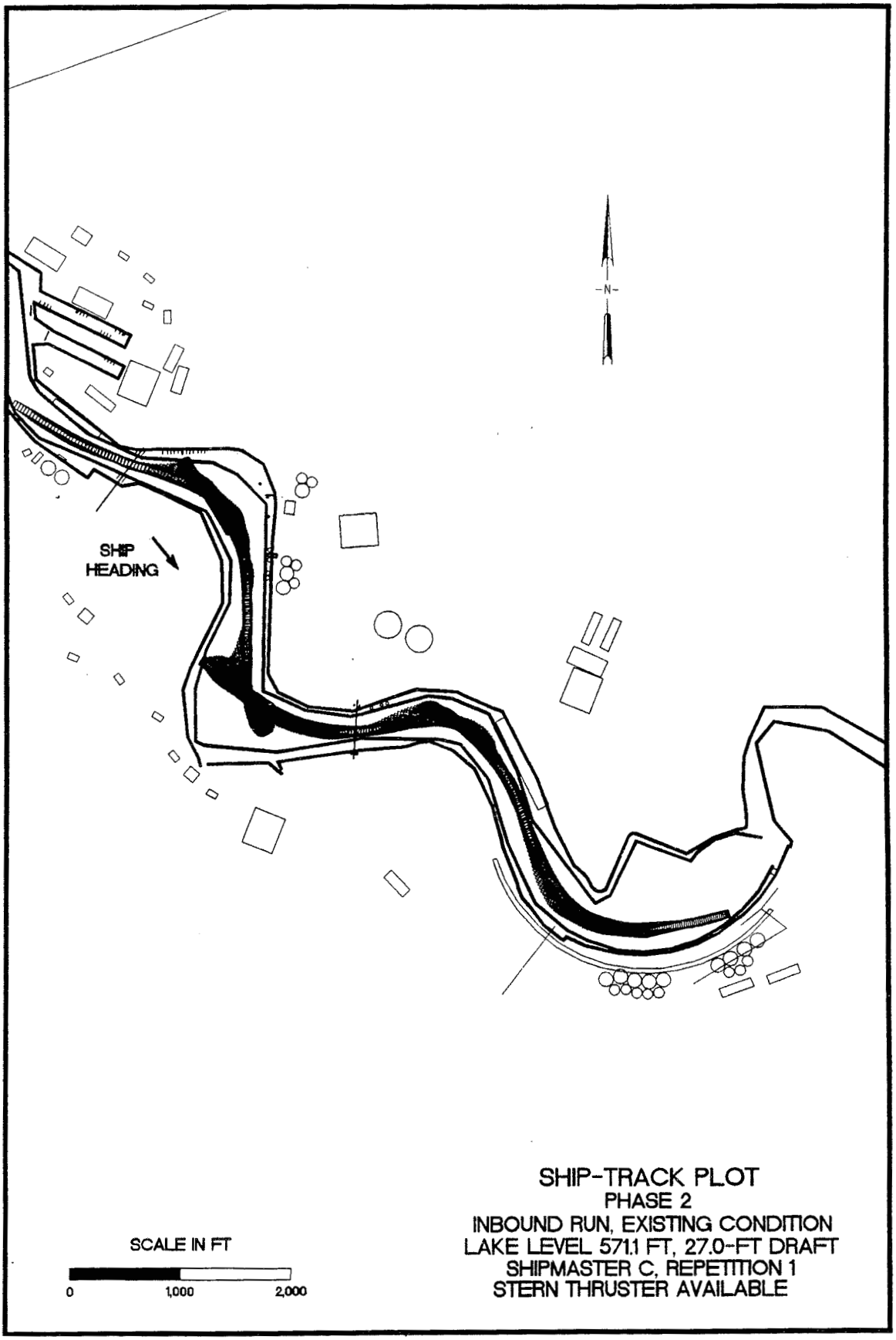
SHIP-TRACK PLOT
PHASE 1, TURNING BASIN
OUTBOUND RUN, PLAN 2
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER B, REPETITION 1



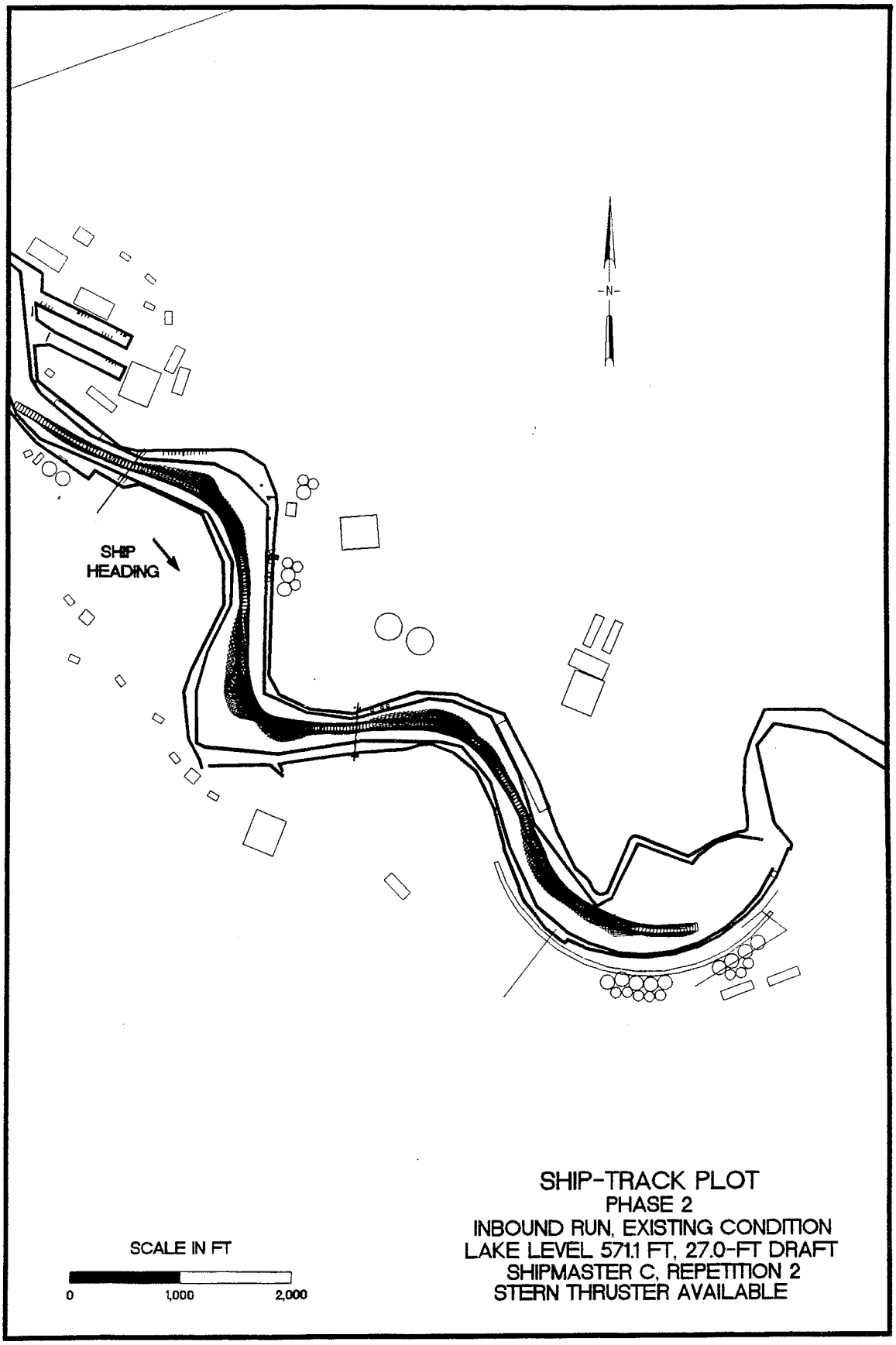
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 24.5-FT DRAFT
SHIPMASTER C, REPETITION 1
STERN THRUSTER AVAILABLE



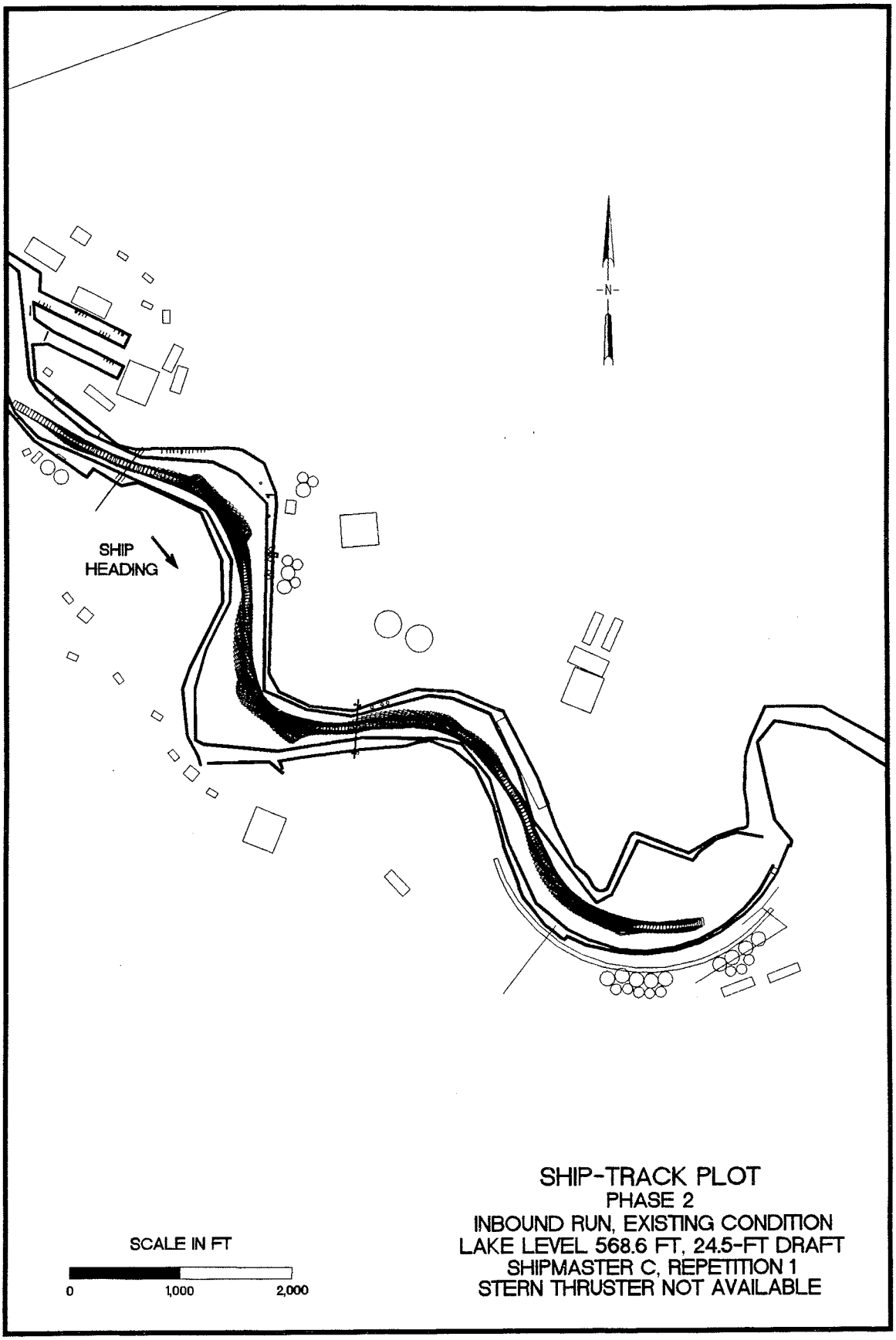
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 24.5-FT DRAFT
SHIPMASTER C, REPETITION 2
STERN THRUSTER AVAILABLE



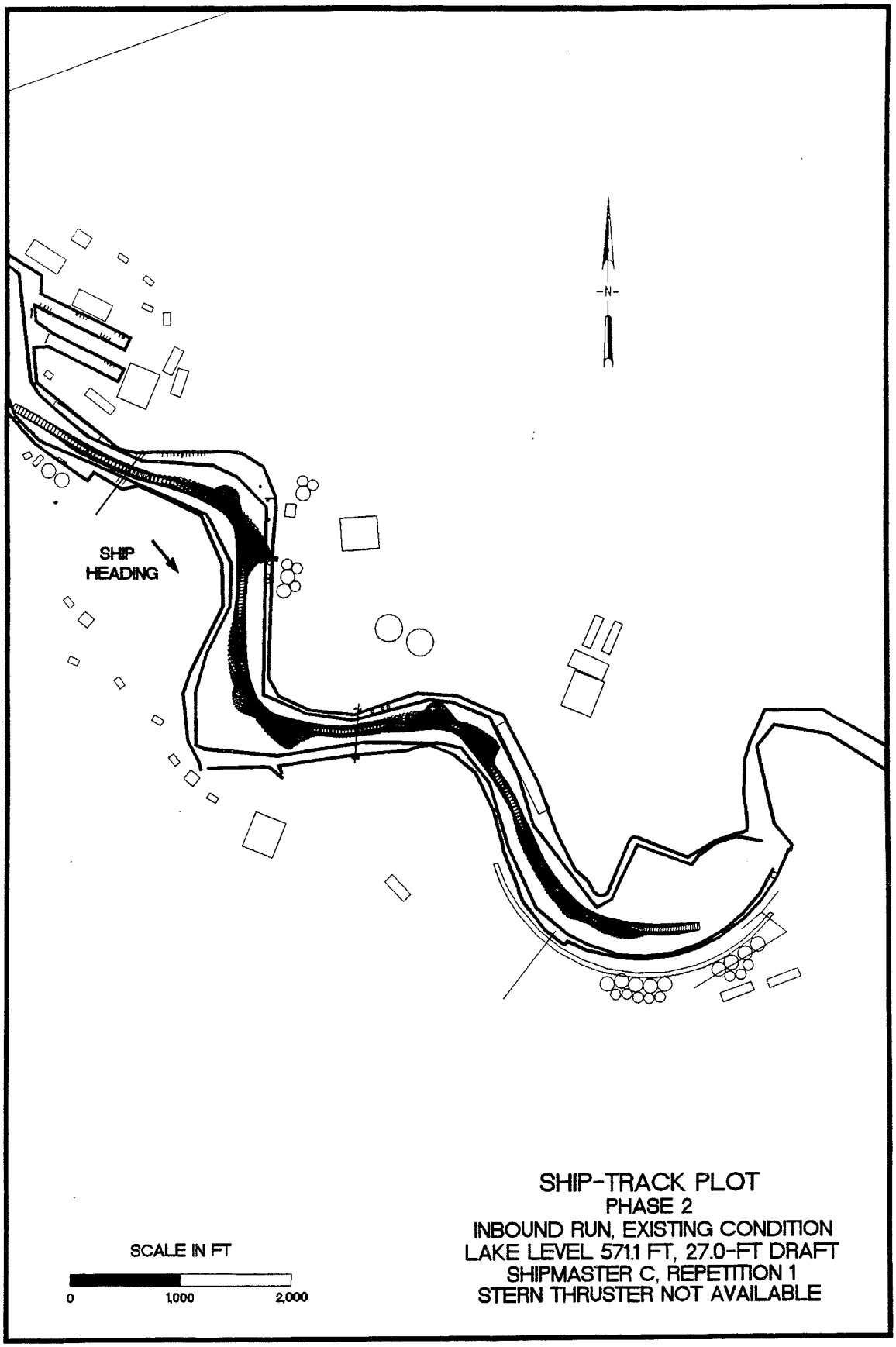
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER C, REPETITION 1
STERN THRUSTER AVAILABLE



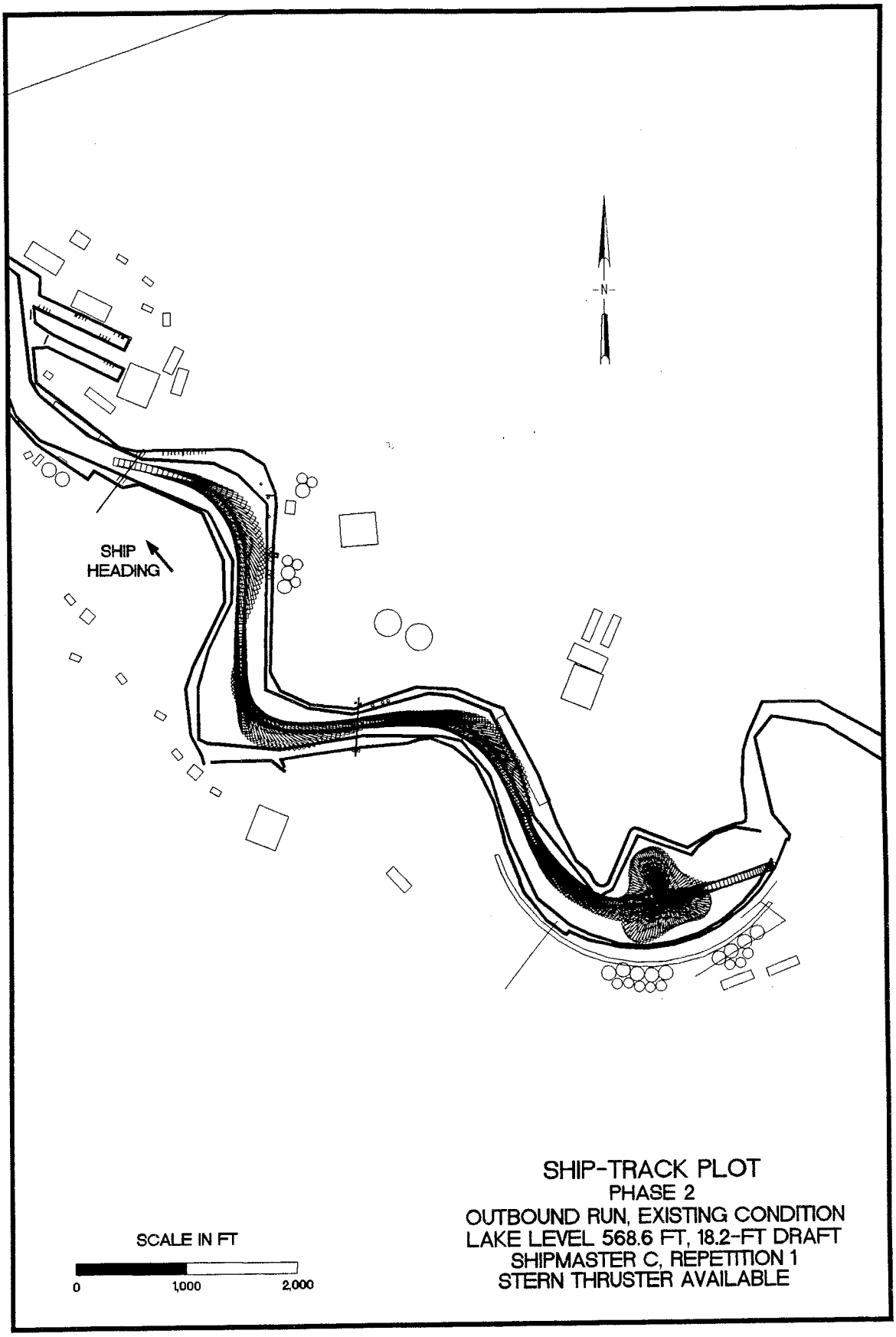
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER C, REPETITION 2
STERN THRUSTER AVAILABLE



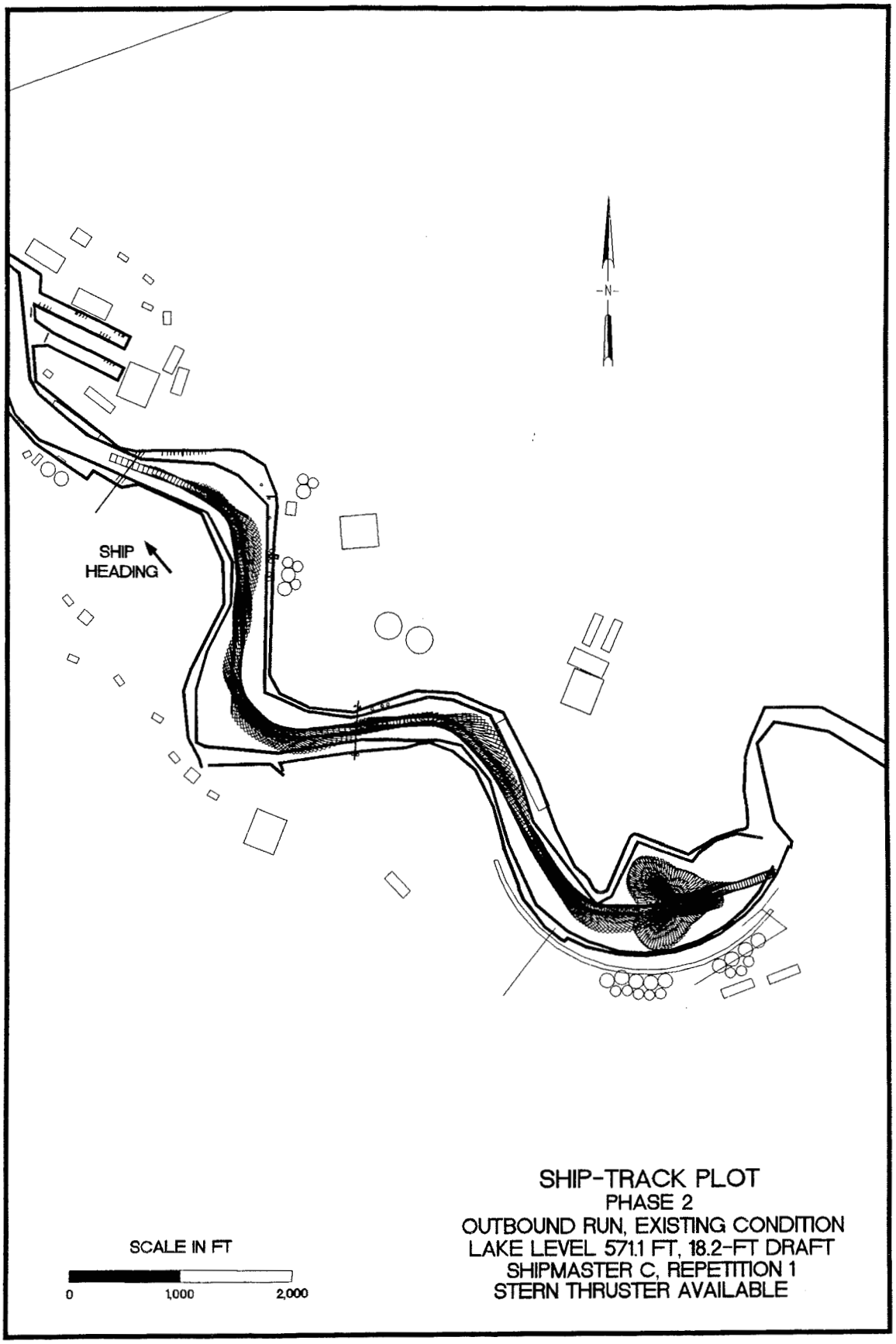
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 24.5-FT DRAFT
SHIPMASTER C, REPETITION 1
STERN THRUSTER NOT AVAILABLE



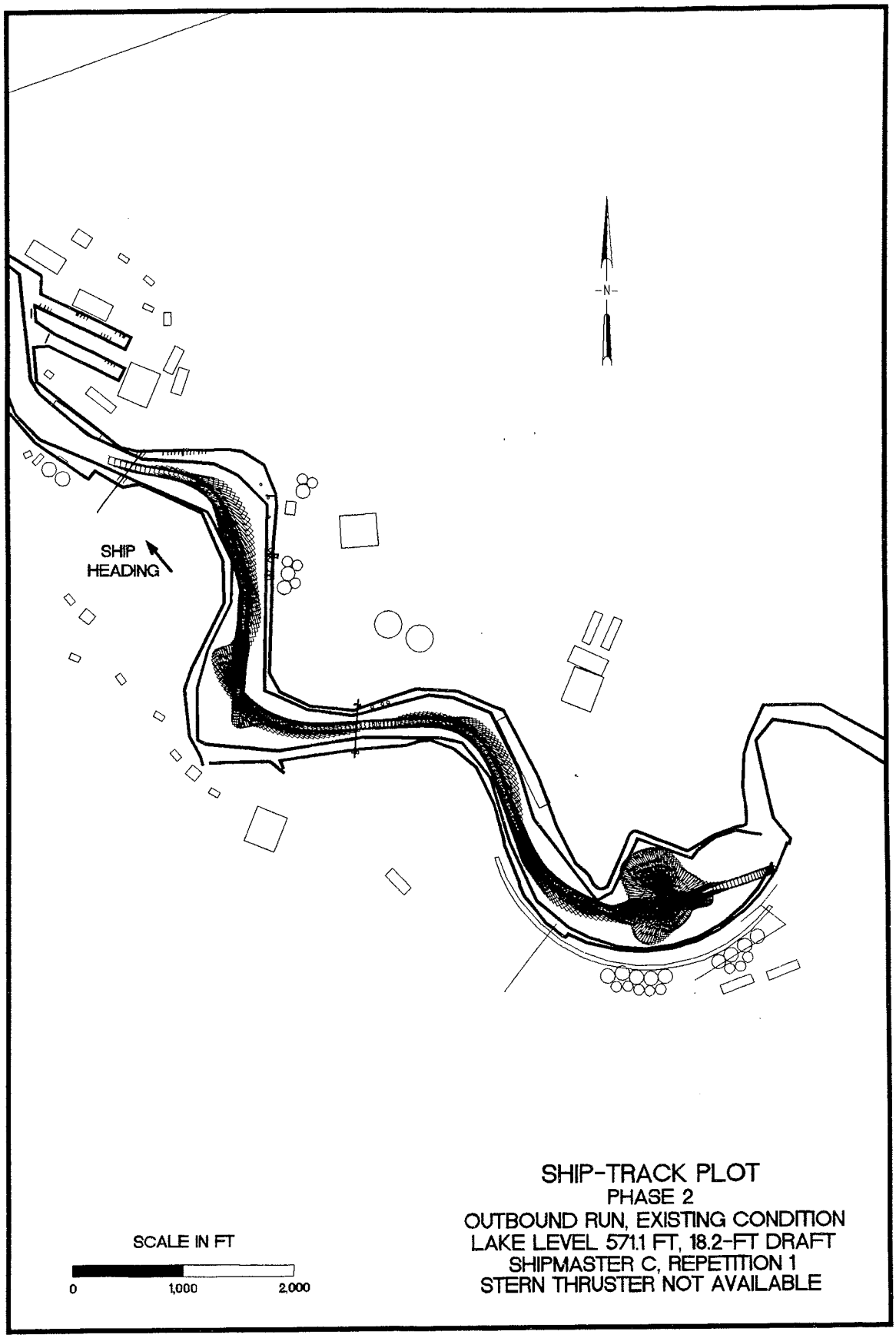
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER C, REPETITION 1
STERN THRUSTER NOT AVAILABLE



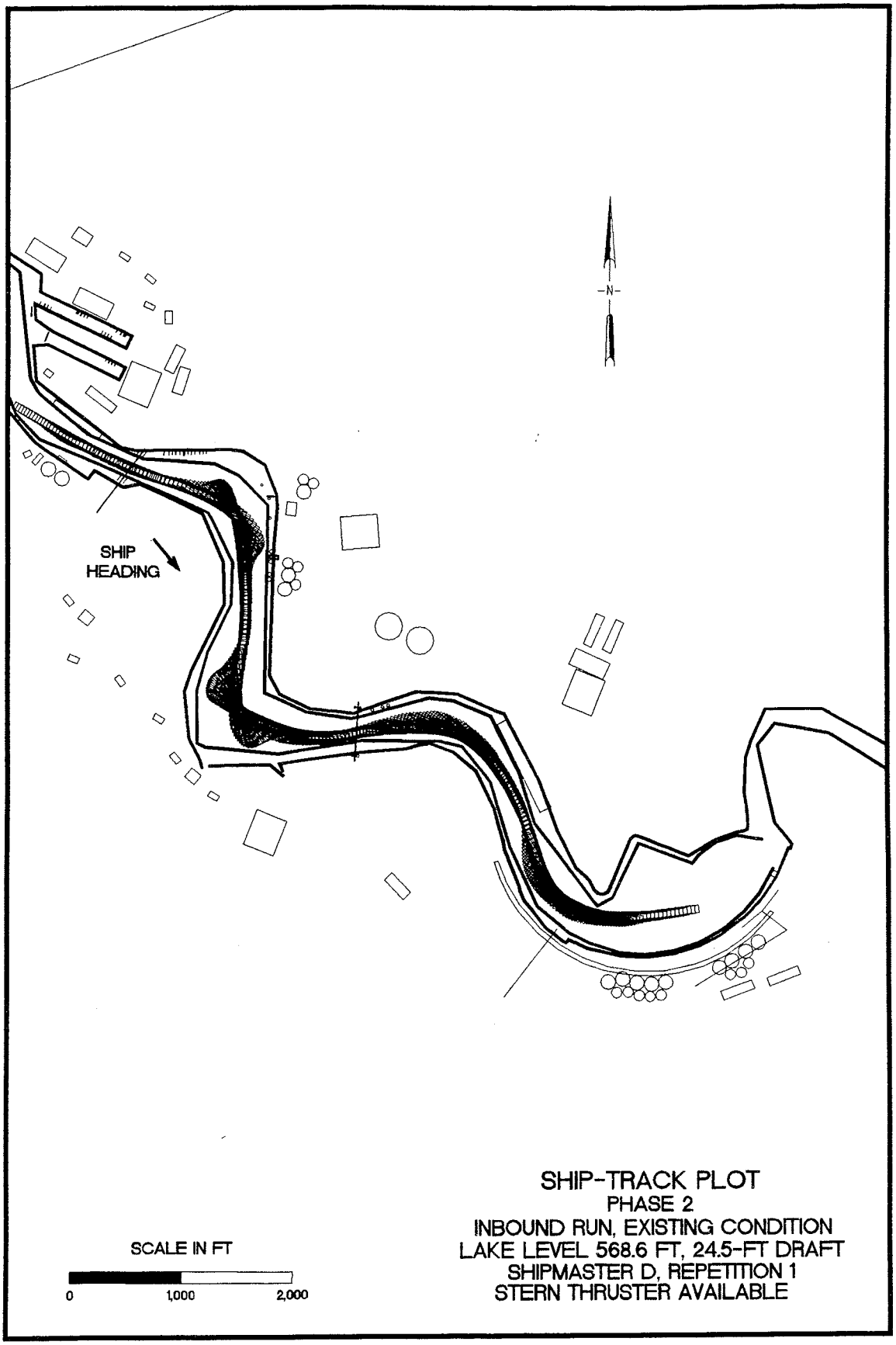
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER C, REPETITION 1
STERN THRUSTER AVAILABLE



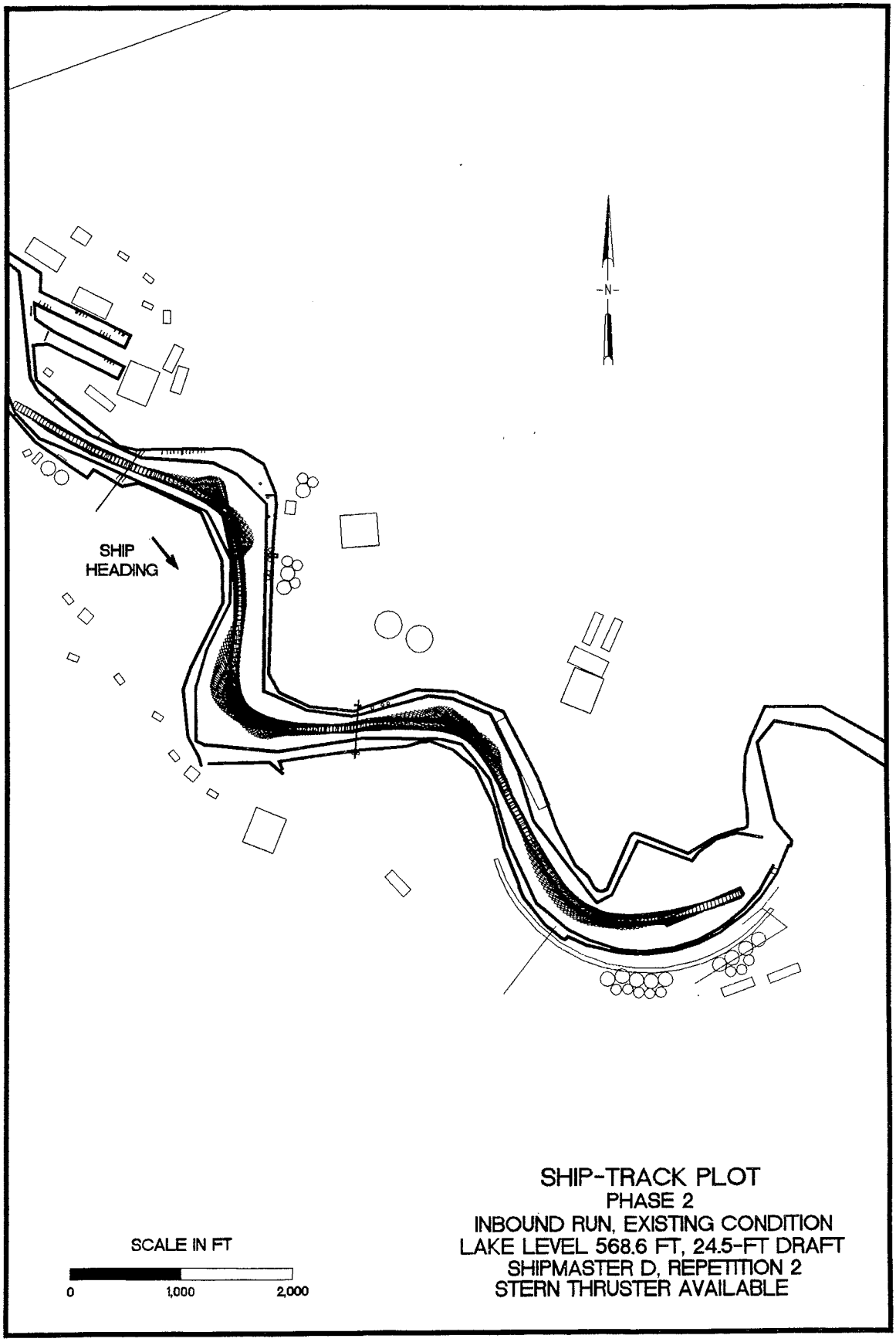
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, EXISTING CONDITION
LAKE LEVEL 571.1 FT, 18.2-FT DRAFT
SHIPMASTER C, REPETITION 1
STERN THRUSTER AVAILABLE



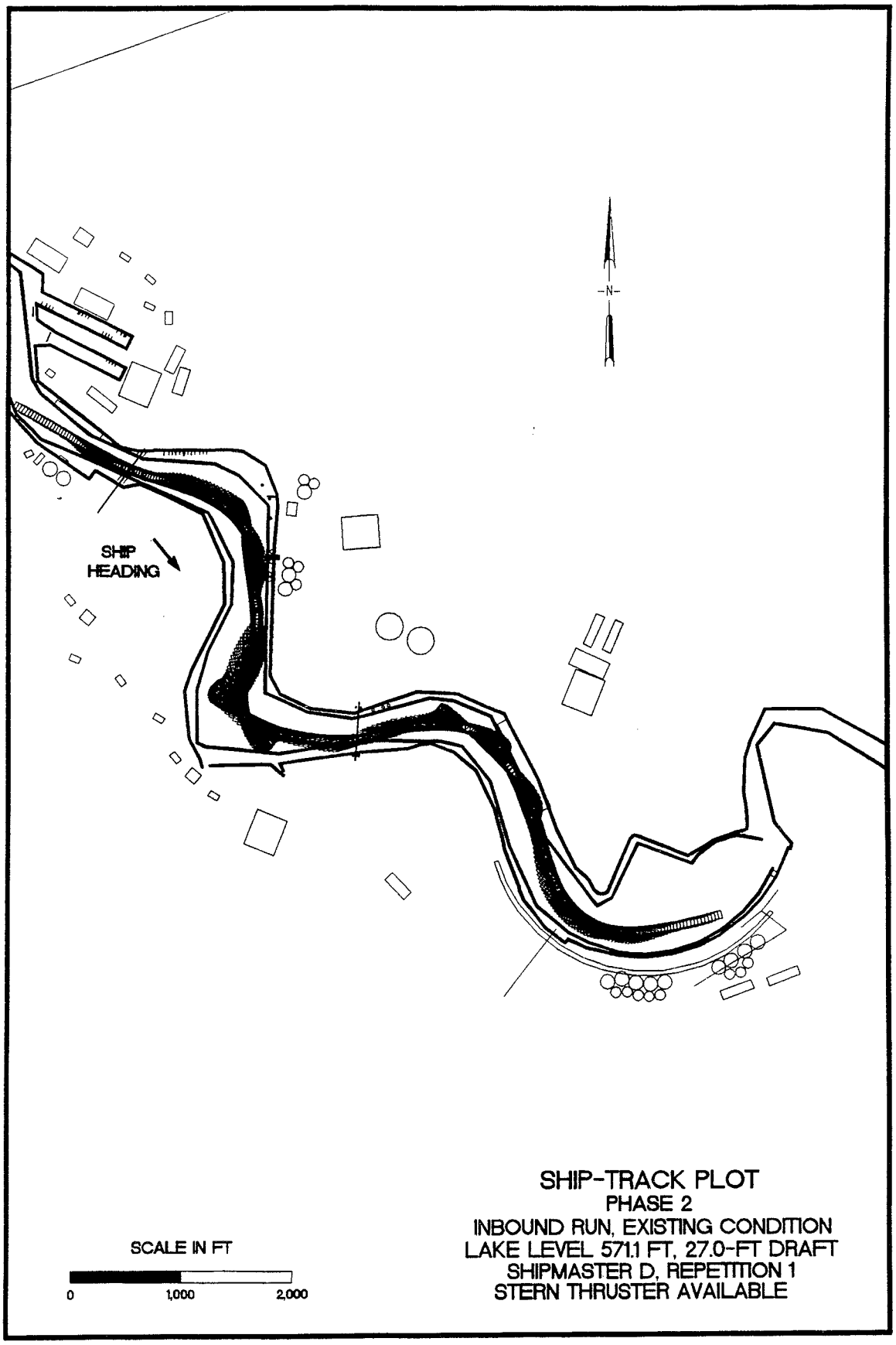
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, EXISTING CONDITION
LAKE LEVEL 571.1 FT, 18.2-FT DRAFT
SHIPMASTER C, REPETITION 1
STERN THRUSTER NOT AVAILABLE



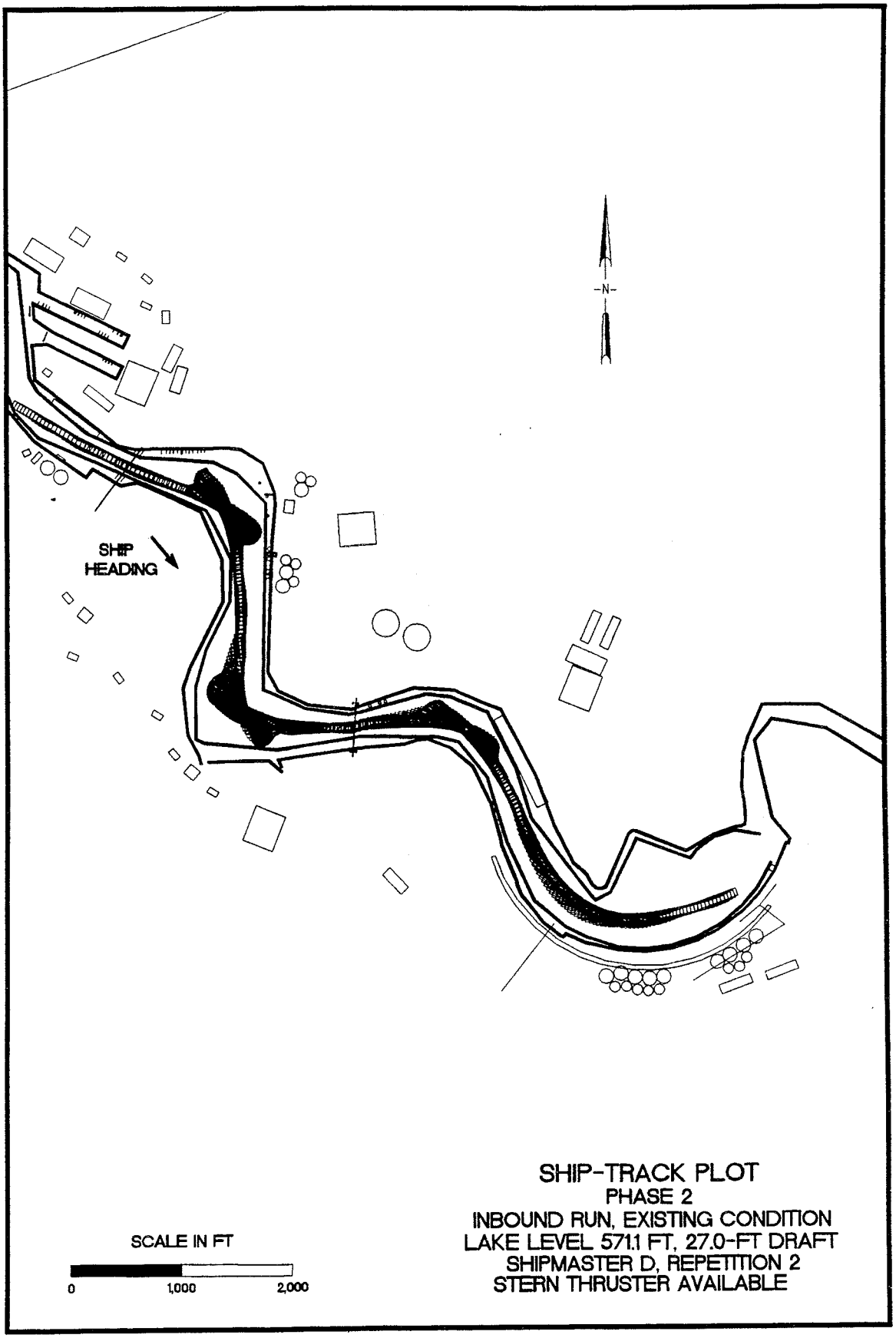
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 24.5-FT DRAFT
SHIPMASTER D, REPETITION 1
STERN THRUSTER AVAILABLE

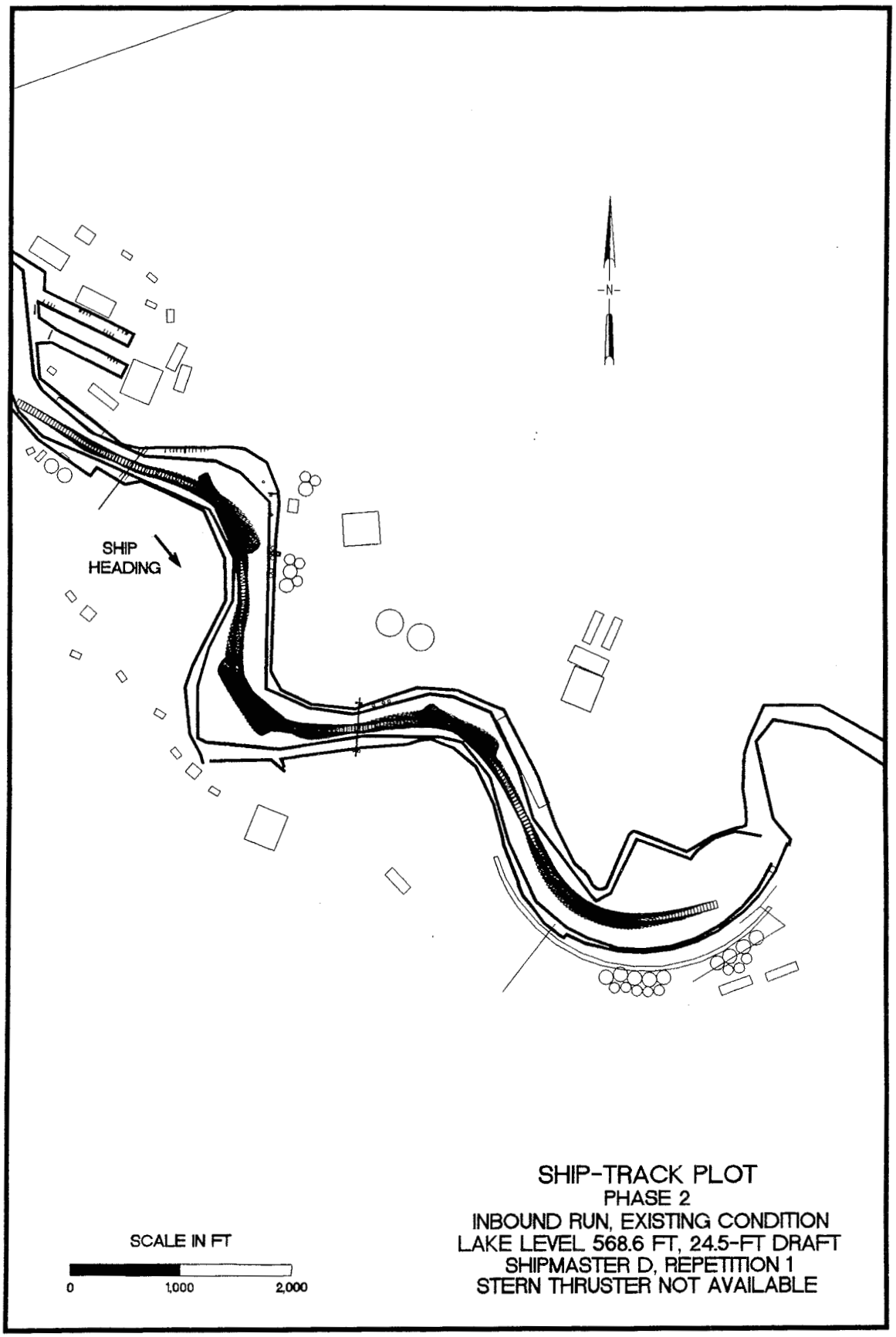


SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 24.5-FT DRAFT
SHIPMASTER D, REPETITION 2
STERN THRUSTER AVAILABLE

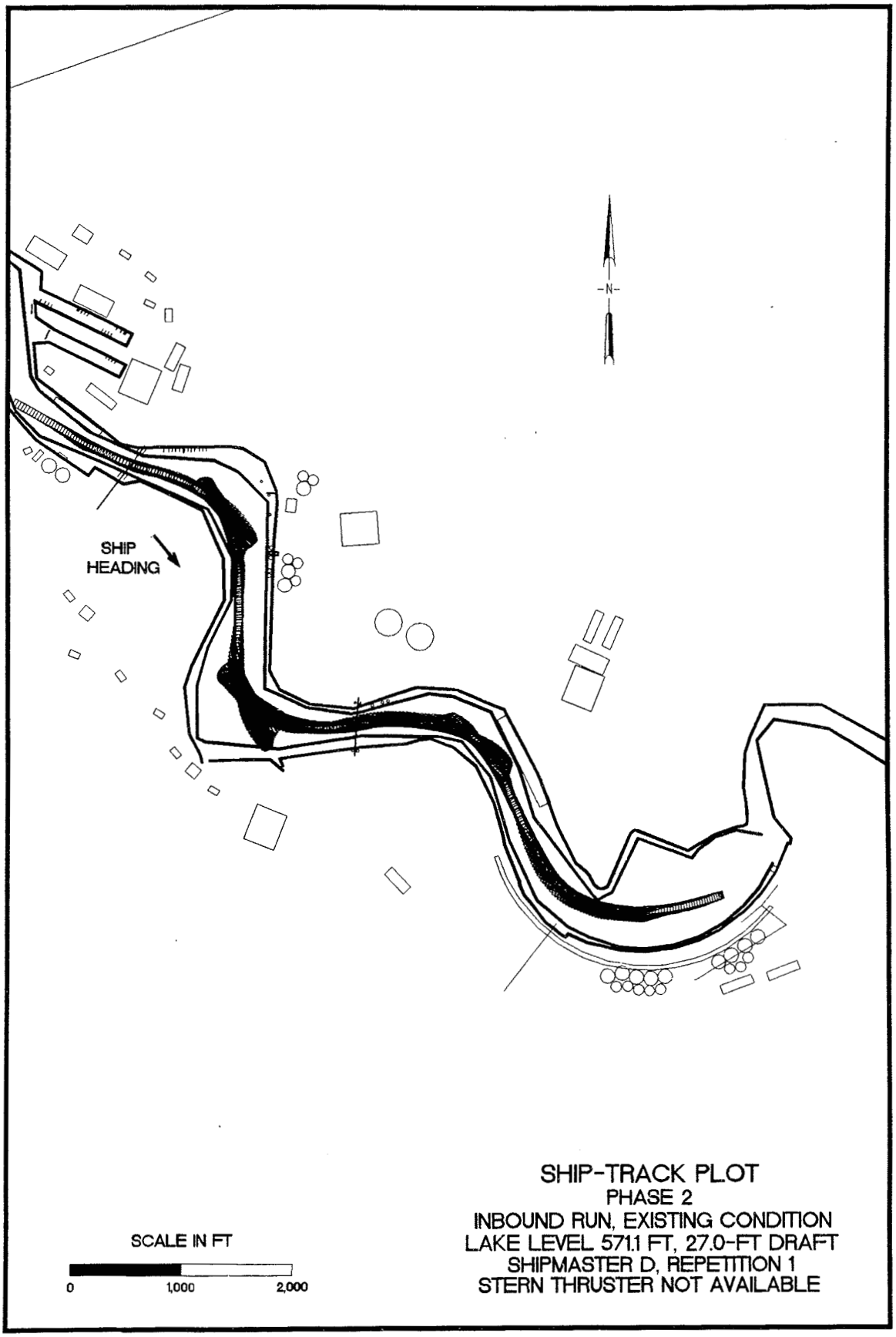


SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER D, REPETITION 1
STERN THRUSTER AVAILABLE

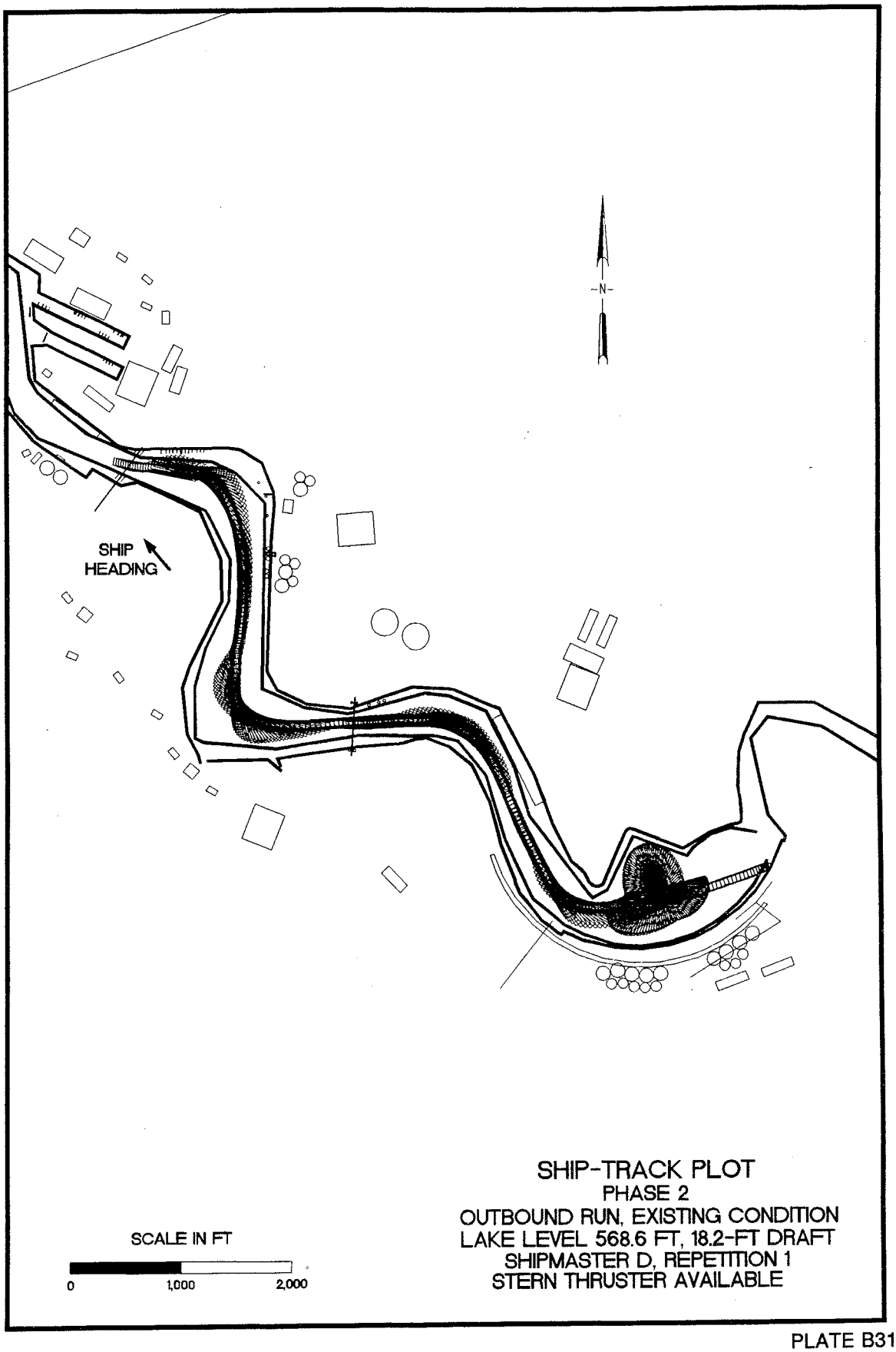

N
SHIP
HEADING
SCALE IN FT
0
1,000
2,000
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER D, REPETITION 2
STERN THRUSTER AVAILABLE



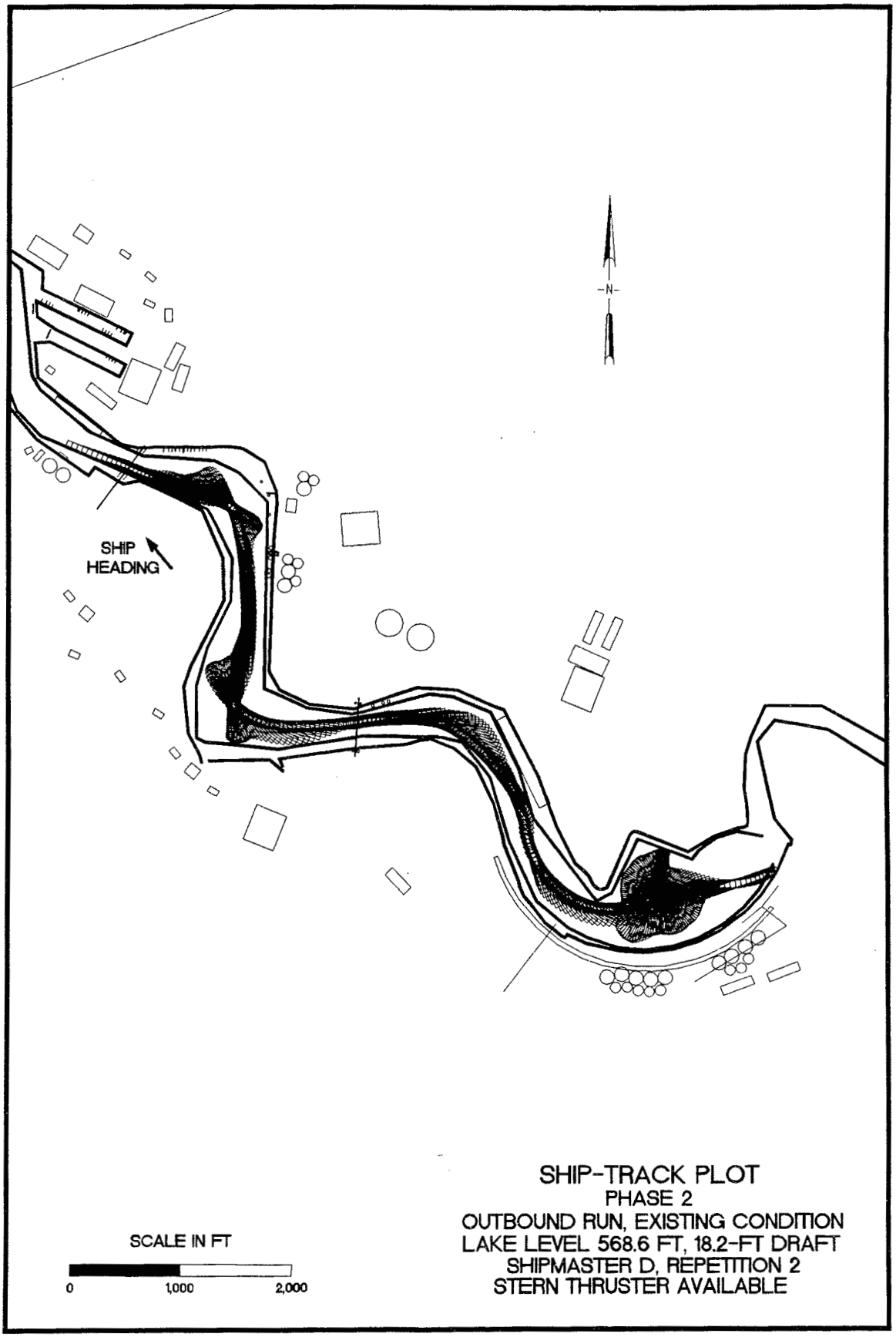
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 24.5-FT DRAFT
SHIPMASTER D, REPETITION 1
STERN THRUSTER NOT AVAILABLE



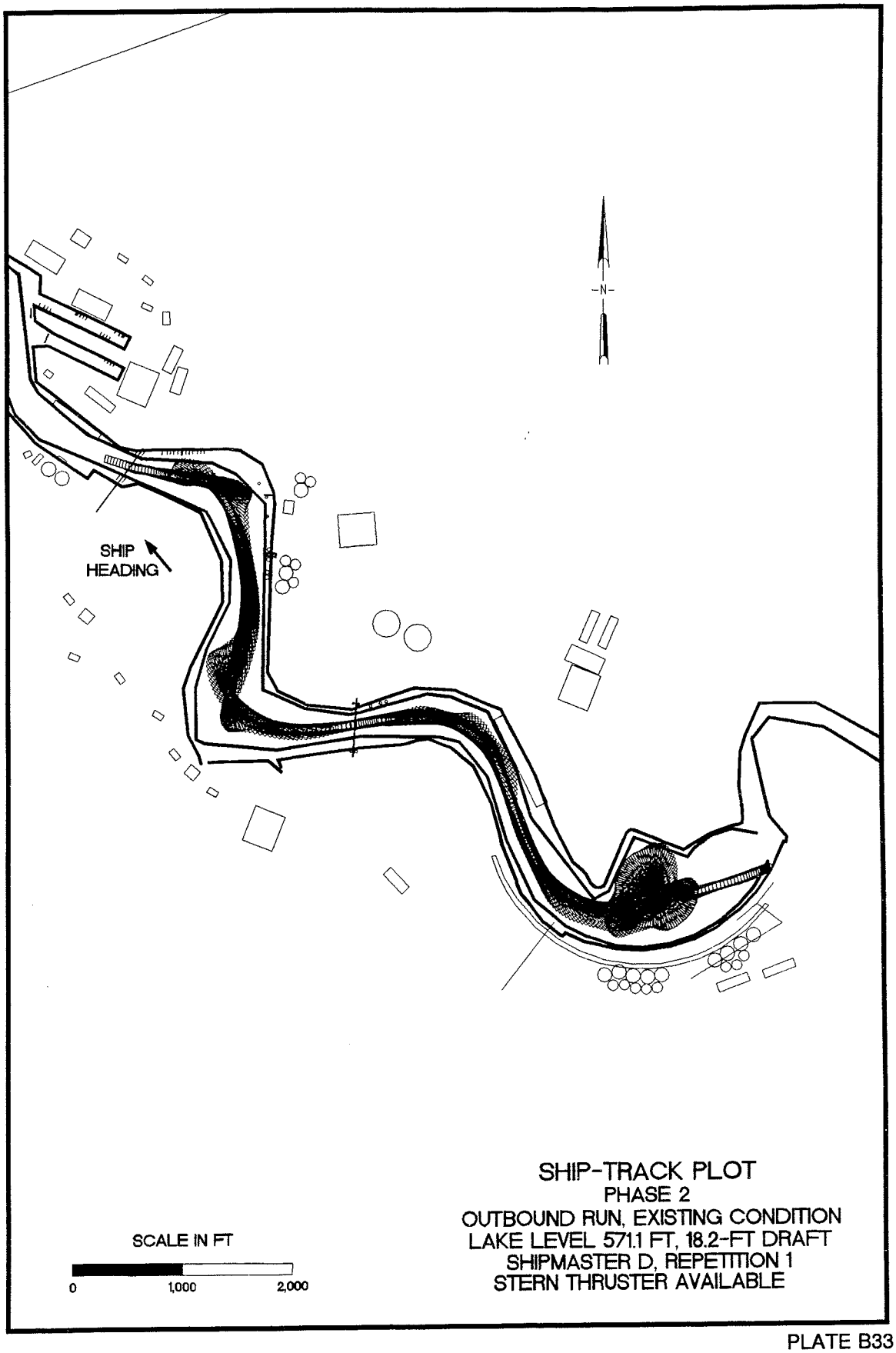
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER D, REPETITION 1
STERN THRUSTER NOT AVAILABLE



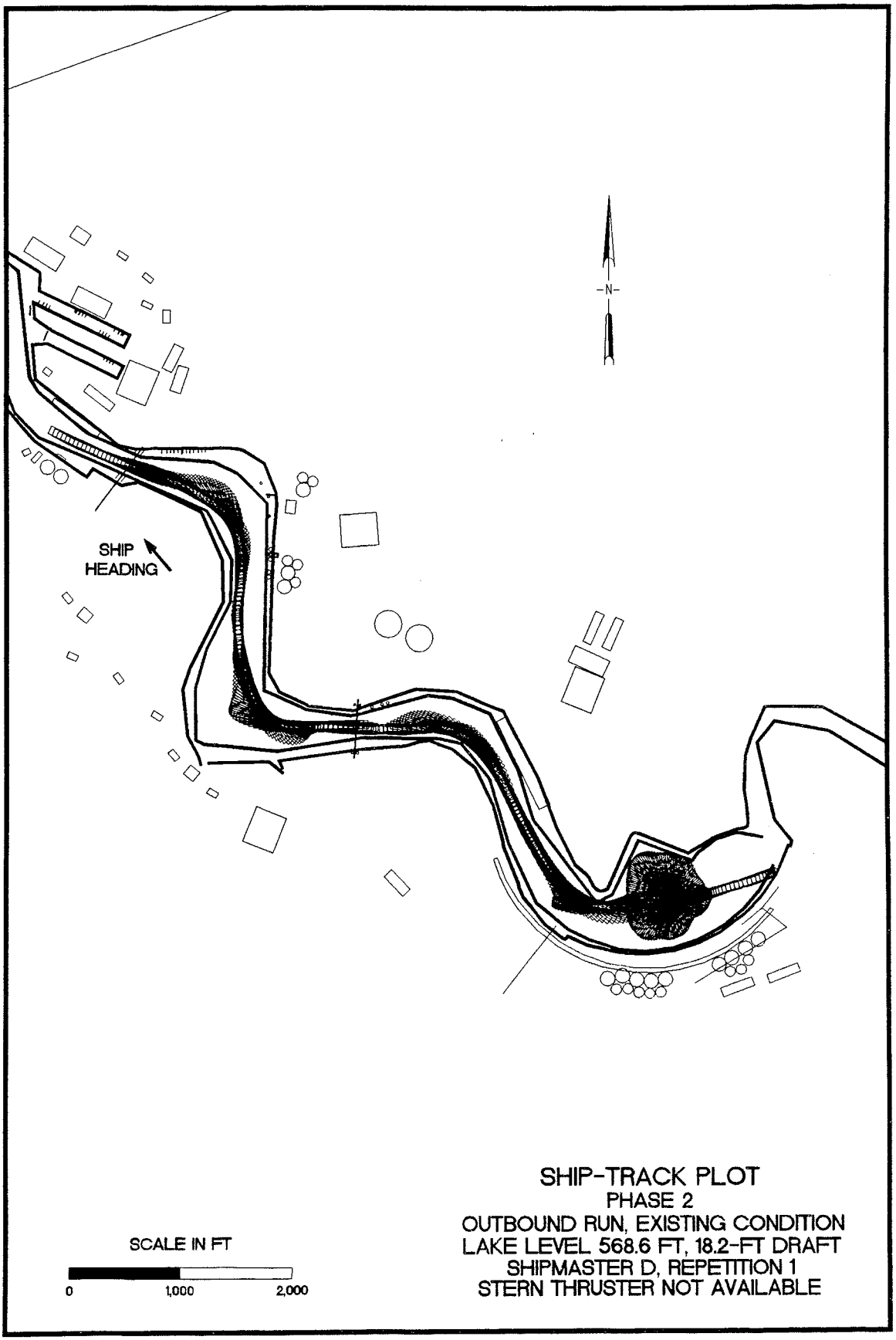
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER D, REPETITION 1
STERN THRUSTER AVAILABLE



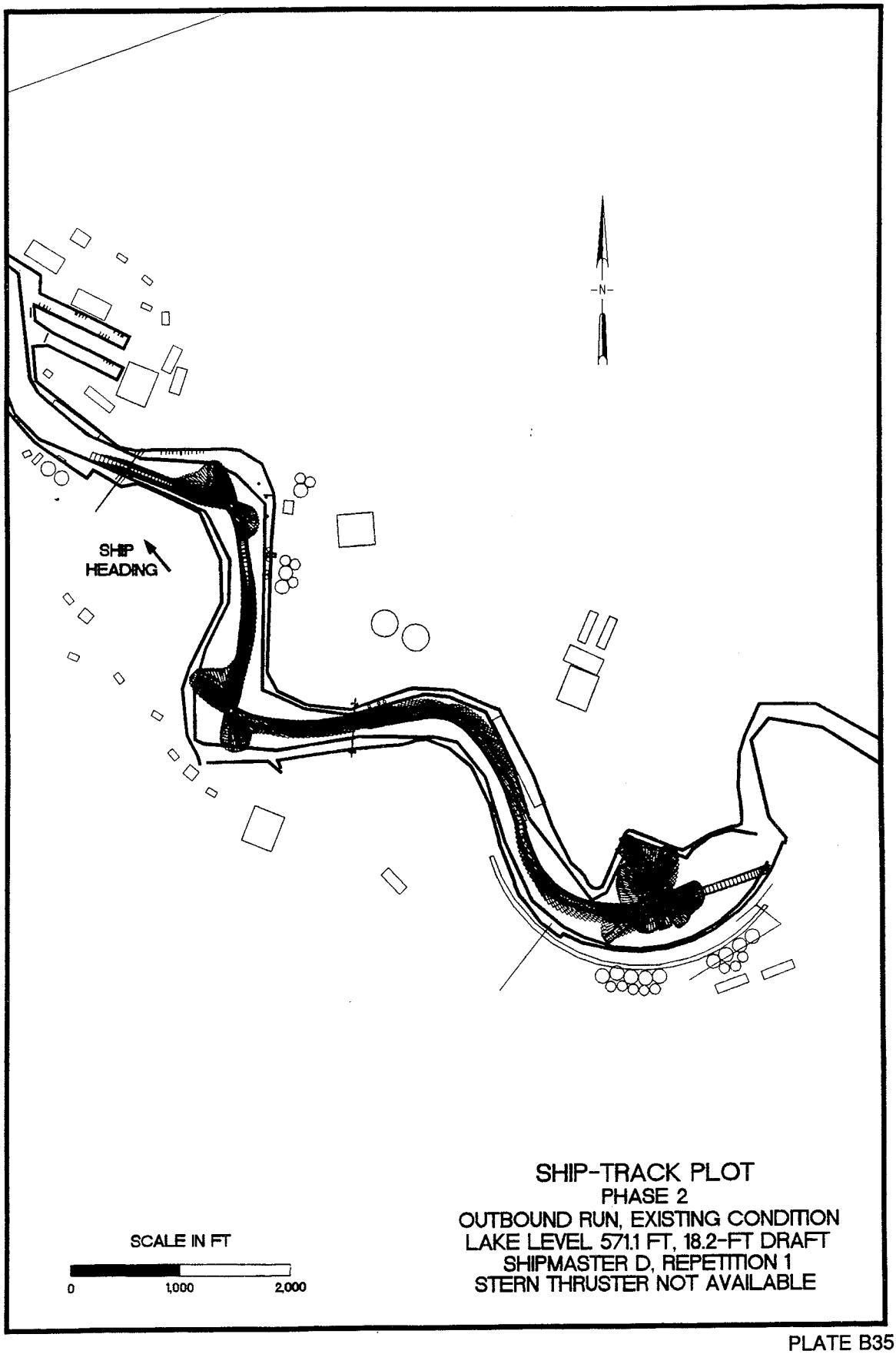
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER D, REPETITION 2
STERN THRUSTER AVAILABLE



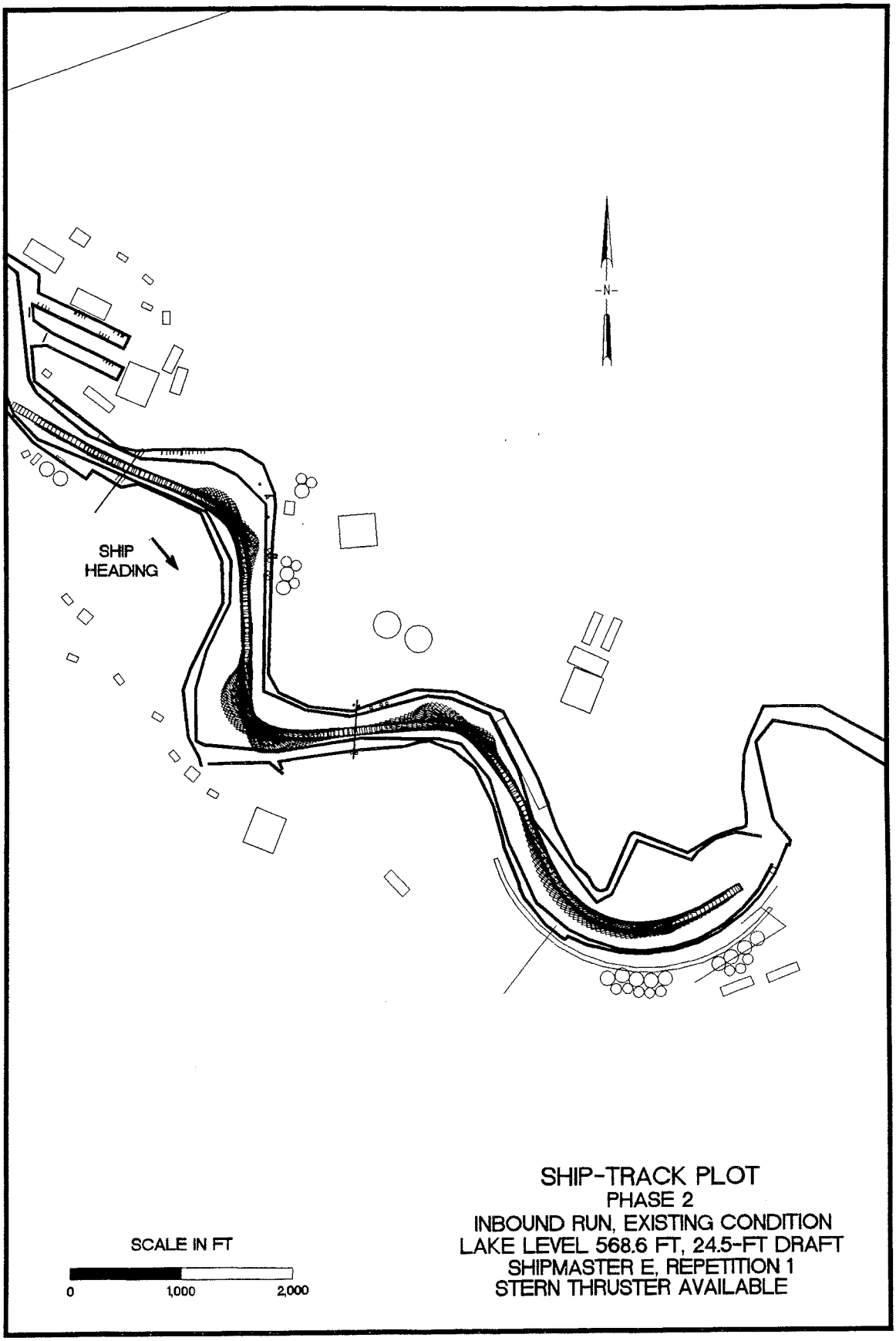
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, EXISTING CONDITION
LAKE LEVEL 571.1 FT, 18.2-FT DRAFT
SHIPMASTER D, REPETITION 1
STERN THRUSTER AVAILABLE



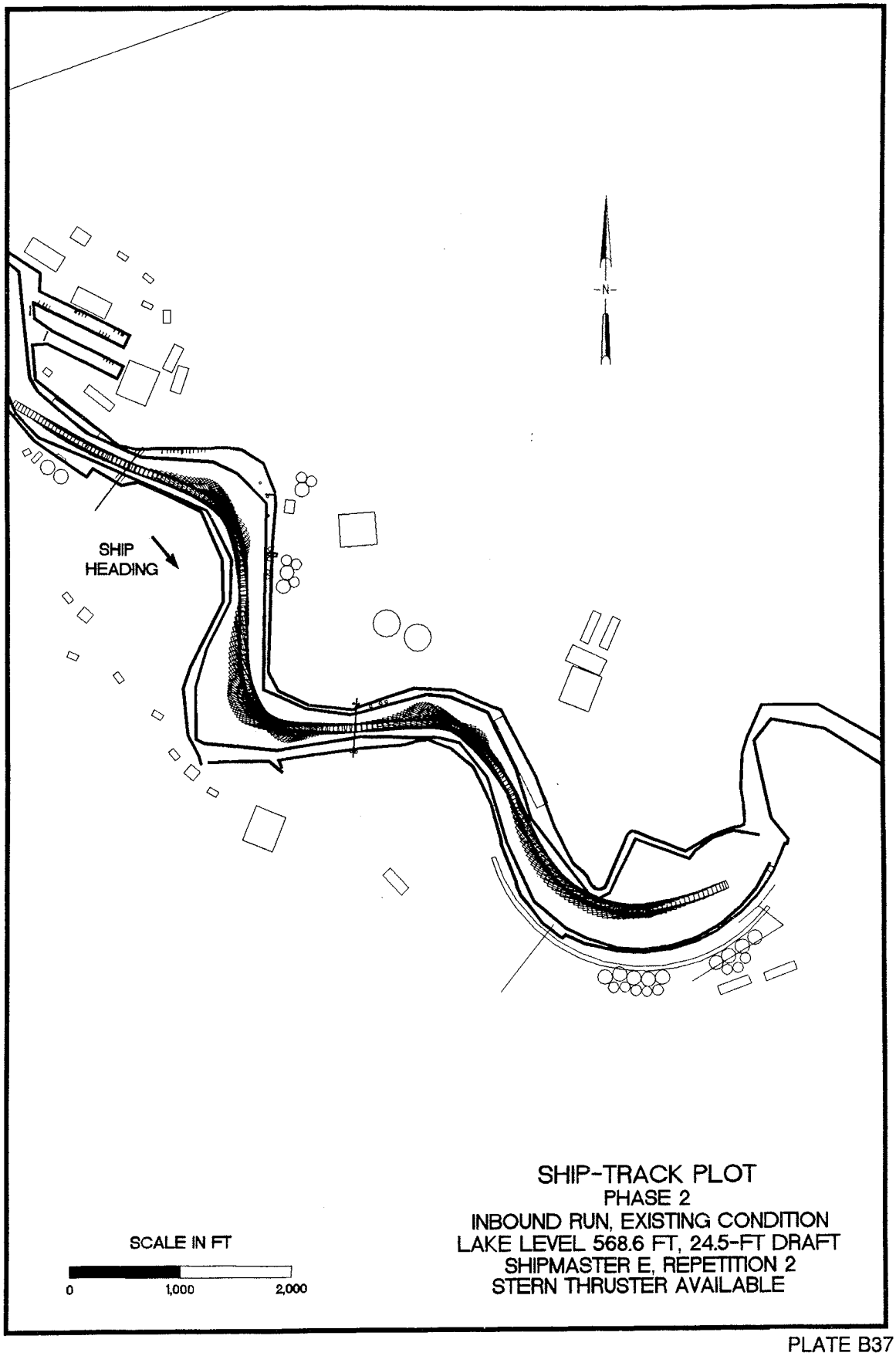
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER D, REPETITION 1
STERN THRUSTER NOT AVAILABLE



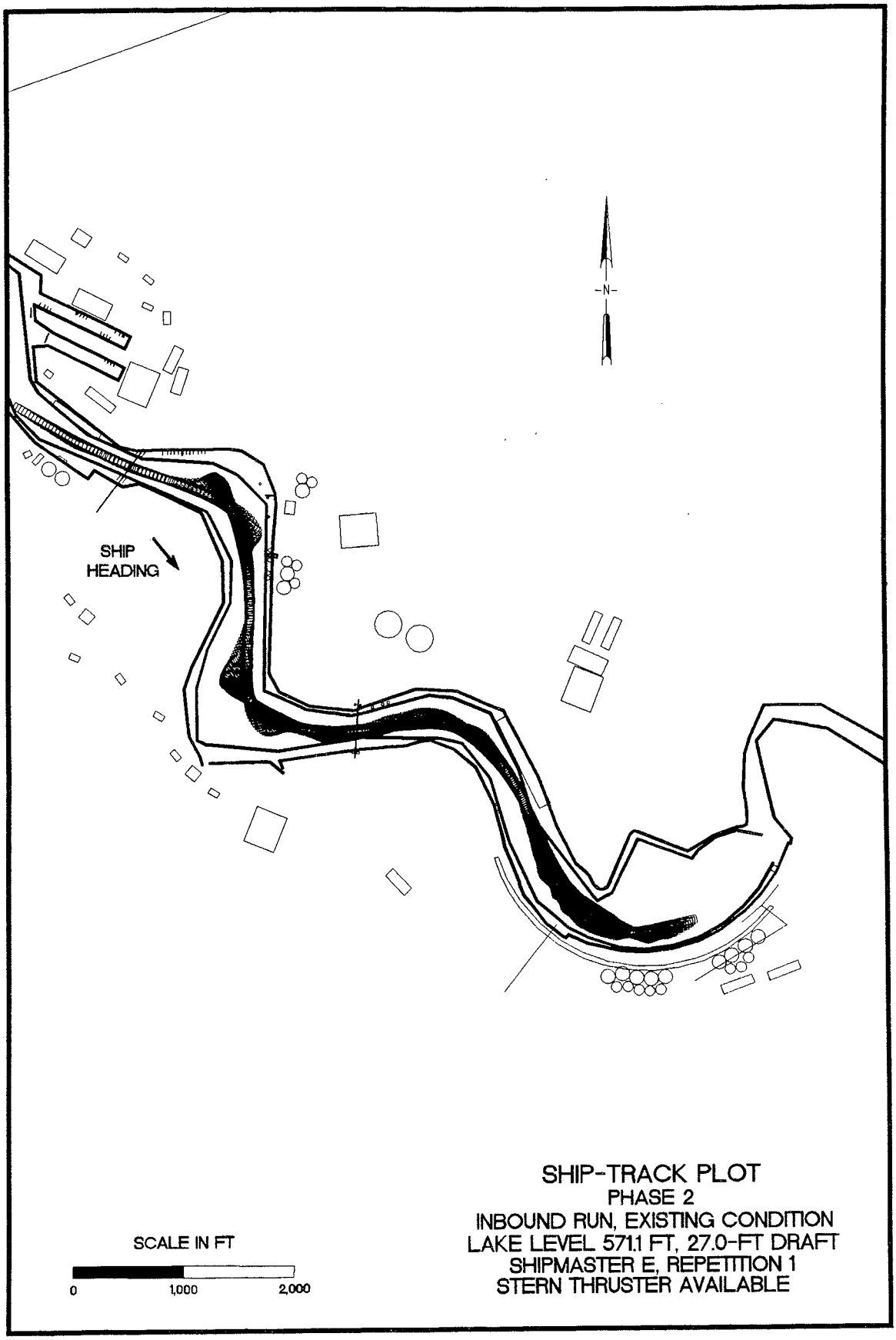
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, EXISTING CONDITION
LAKE LEVEL 571.1 FT, 18.2-FT DRAFT
SHIPMASTER D, REPETITION 1
STERN THRUSTER NOT AVAILABLE



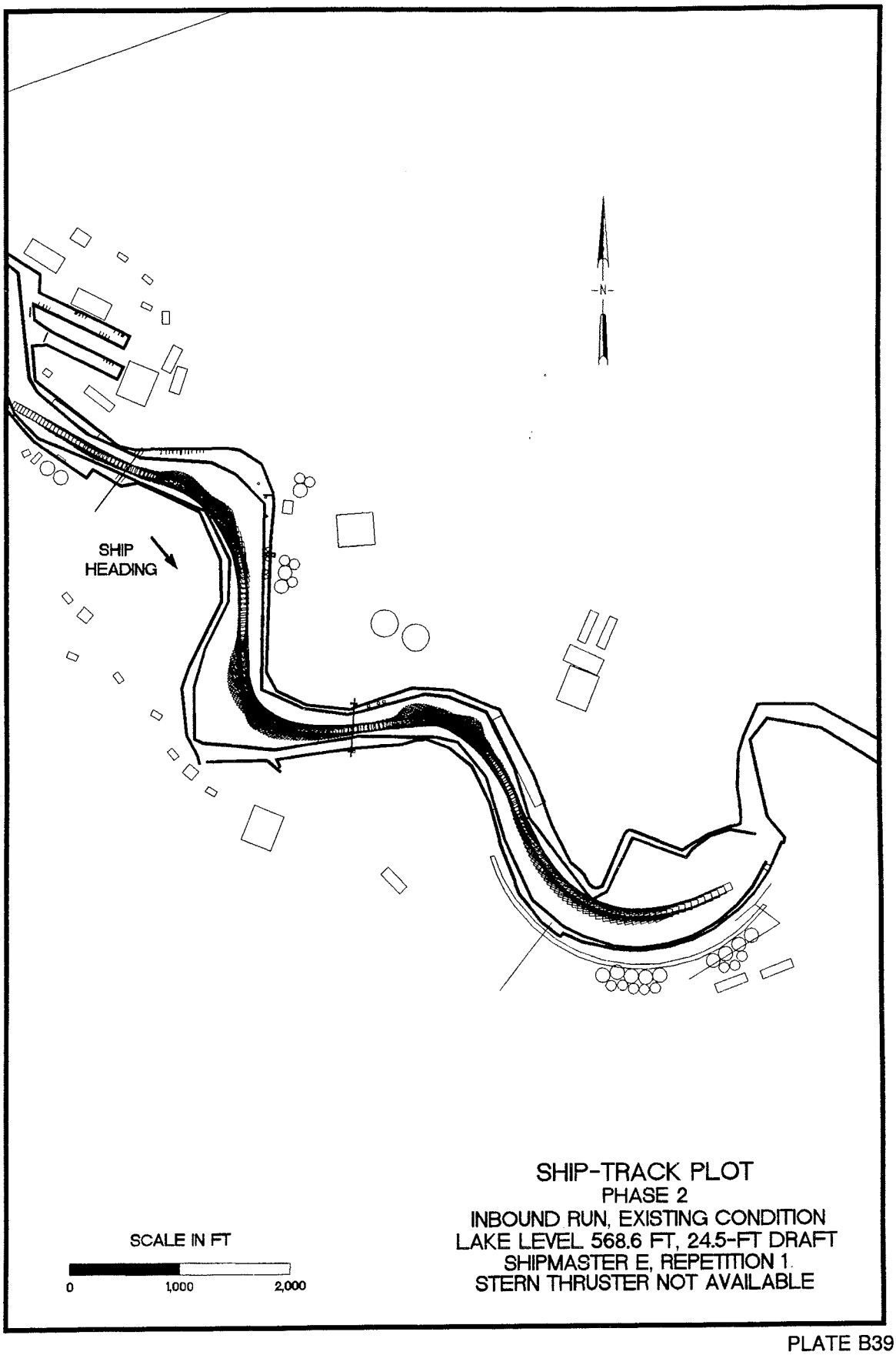
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 24.5-FT DRAFT
SHIPMASTER E, REPETITION 1
STERN THRUSTER AVAILABLE



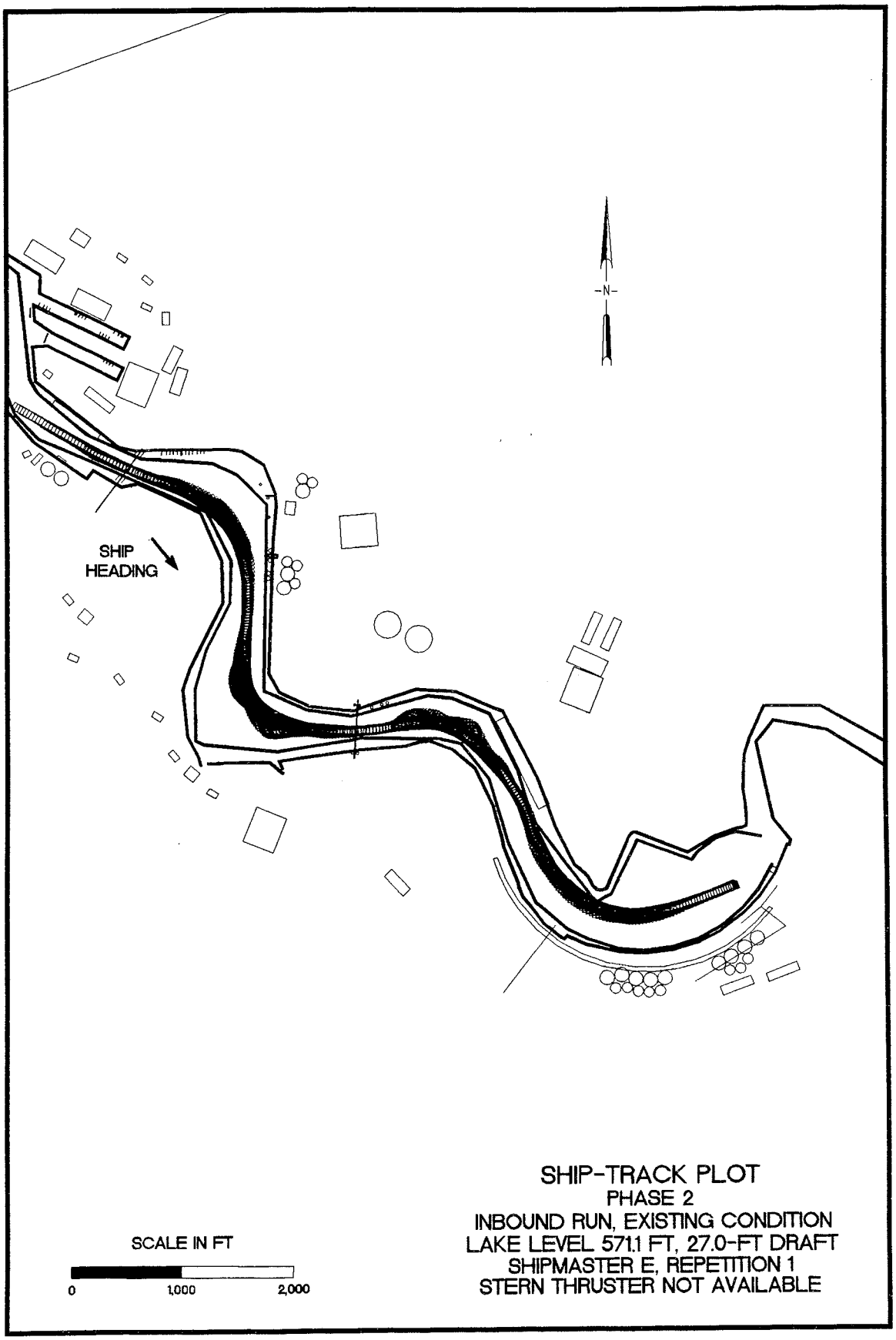
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 24.5-FT DRAFT
SHIPMASTER E, REPETITION 2
STERN THRUSTER AVAILABLE



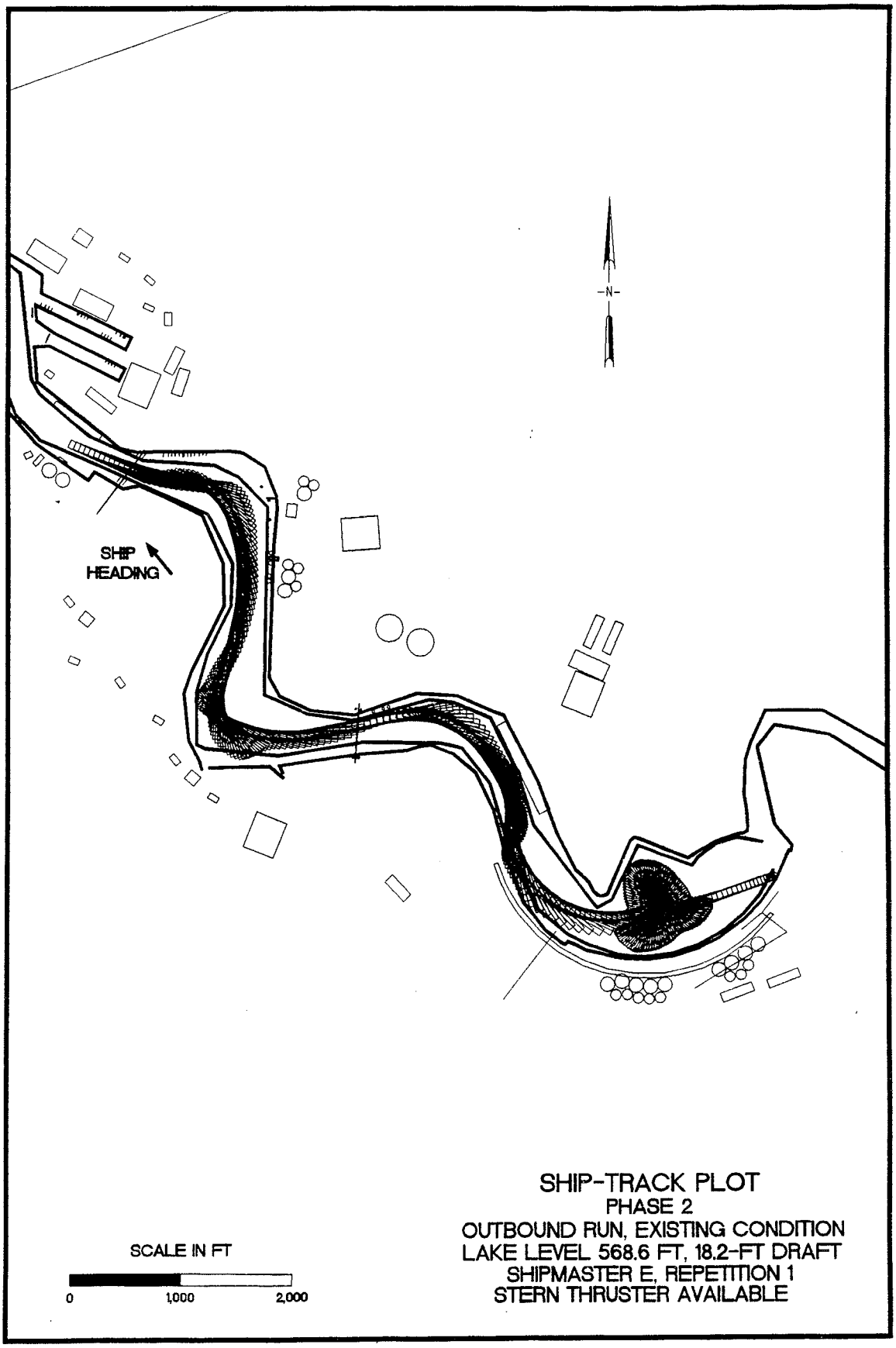
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER E, REPETITION 1
STERN THRUSTER AVAILABLE



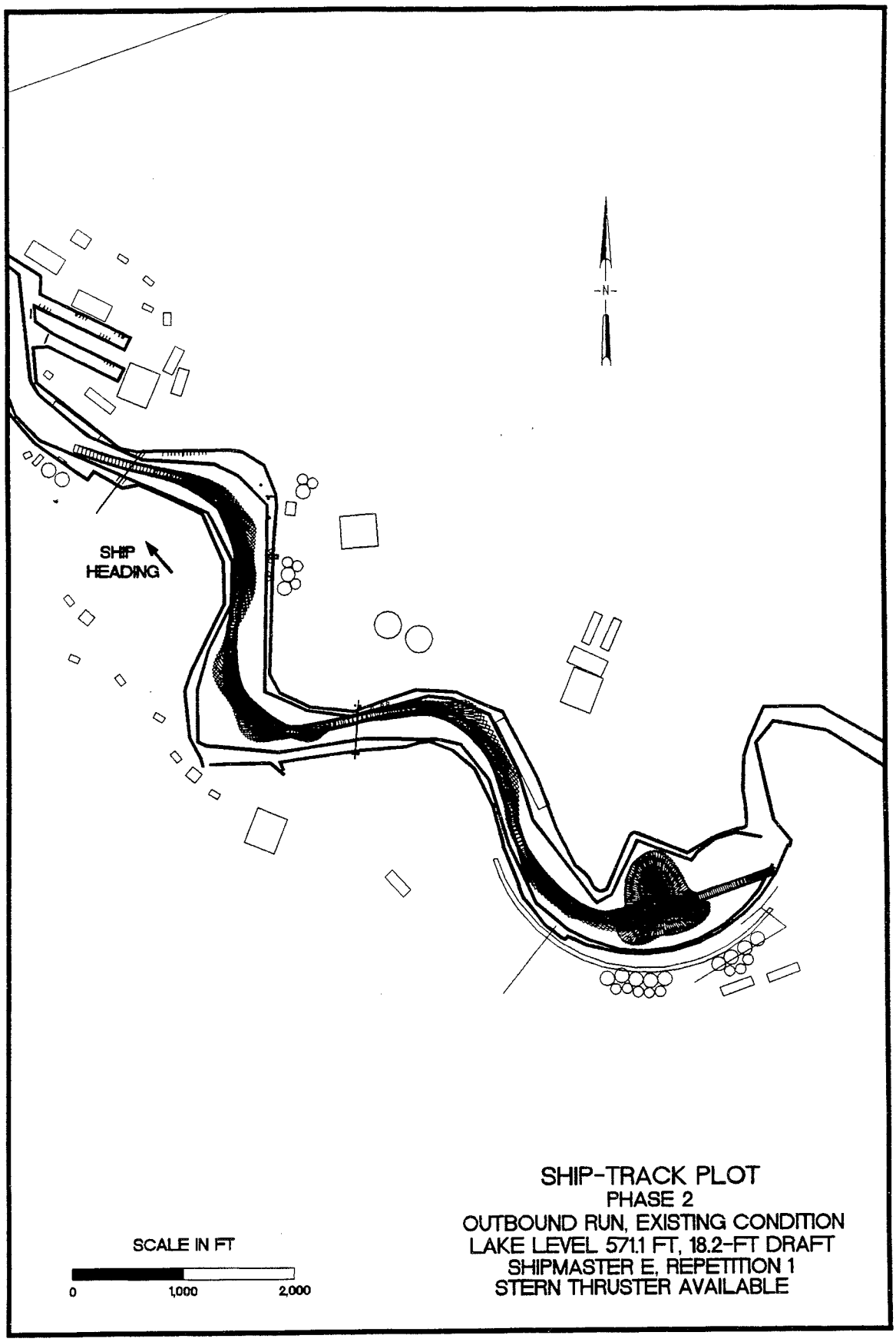
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 24.5-FT DRAFT
SHIPMASTER E, REPETITION 1.
STERN THRUSTER NOT AVAILABLE



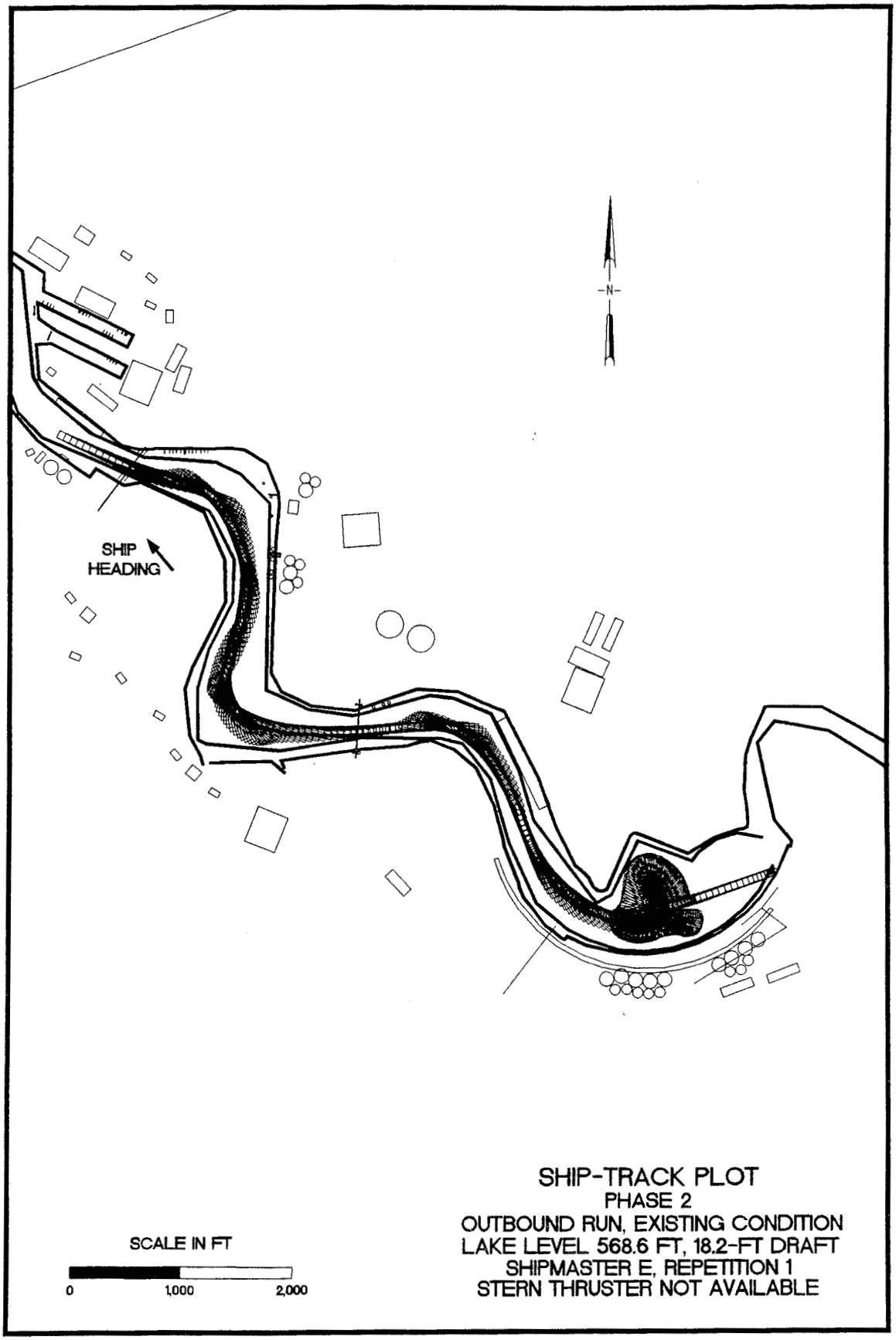
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER E, REPETITION 1
STERN THRUSTER NOT AVAILABLE



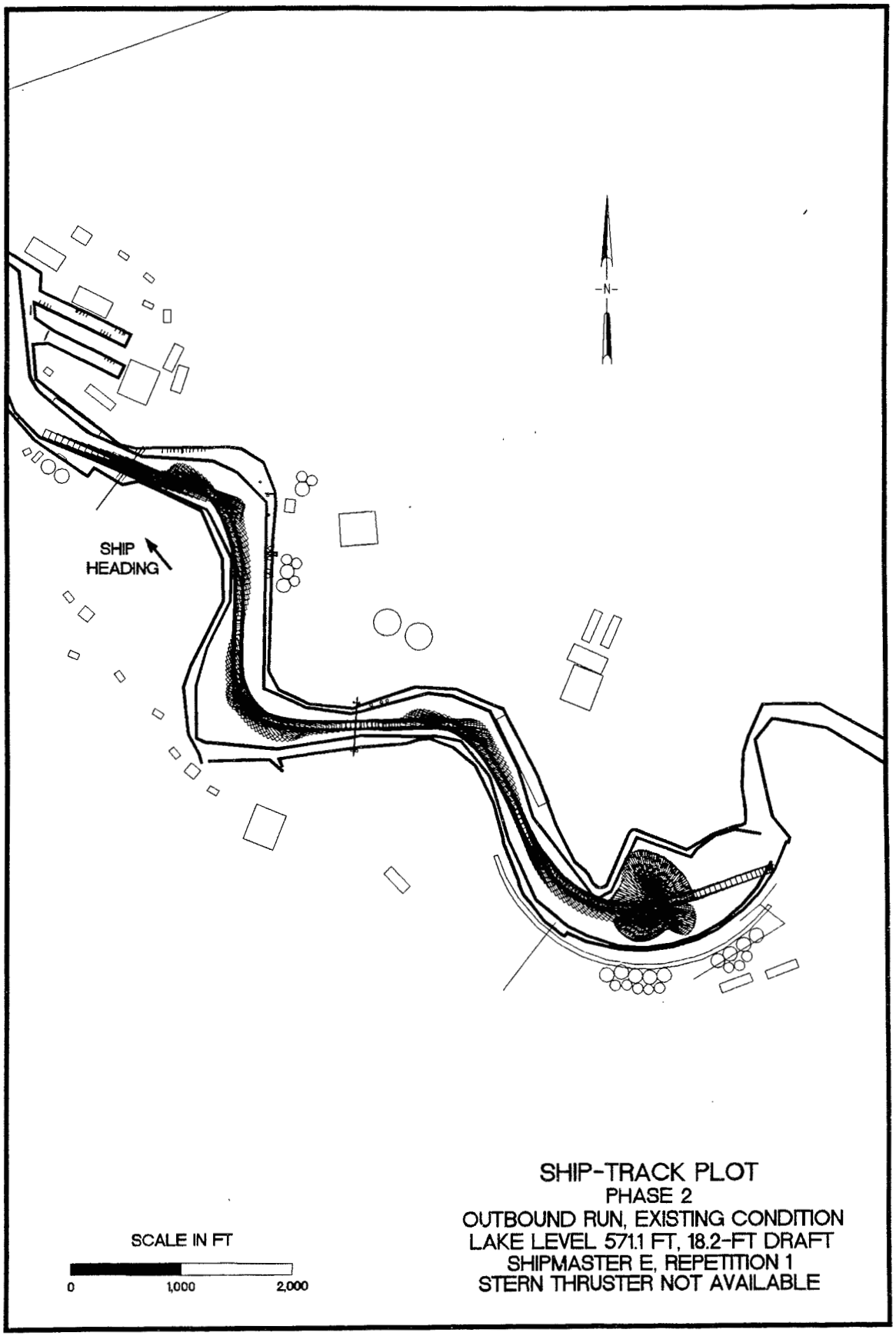
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER E, REPETITION 1
STERN THRUSTER AVAILABLE



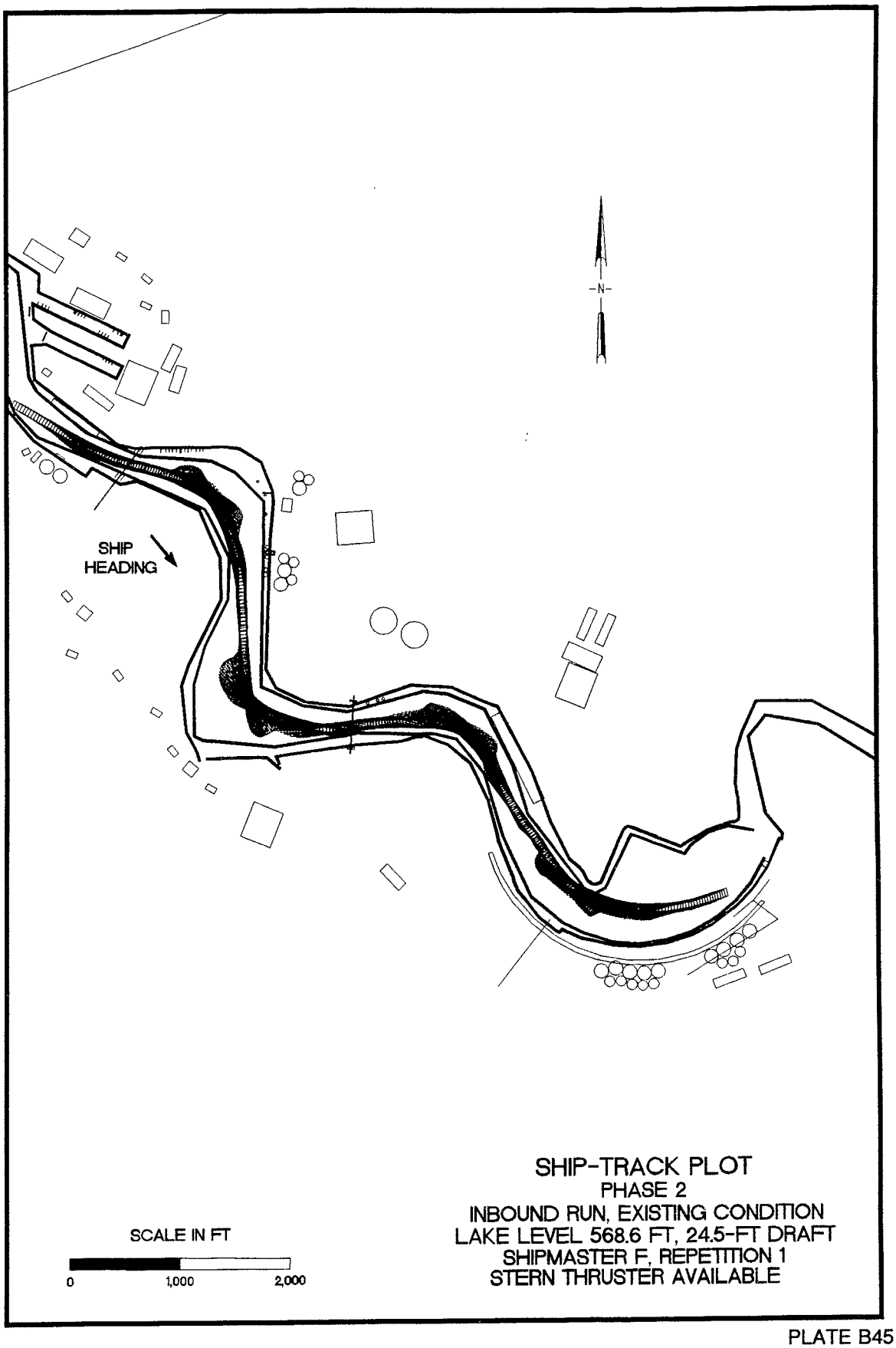
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, EXISTING CONDITION
LAKE LEVEL 571.1 FT, 18.2-FT DRAFT
SHIPMASTER E, REPETITION 1
STERN THRUSTER AVAILABLE



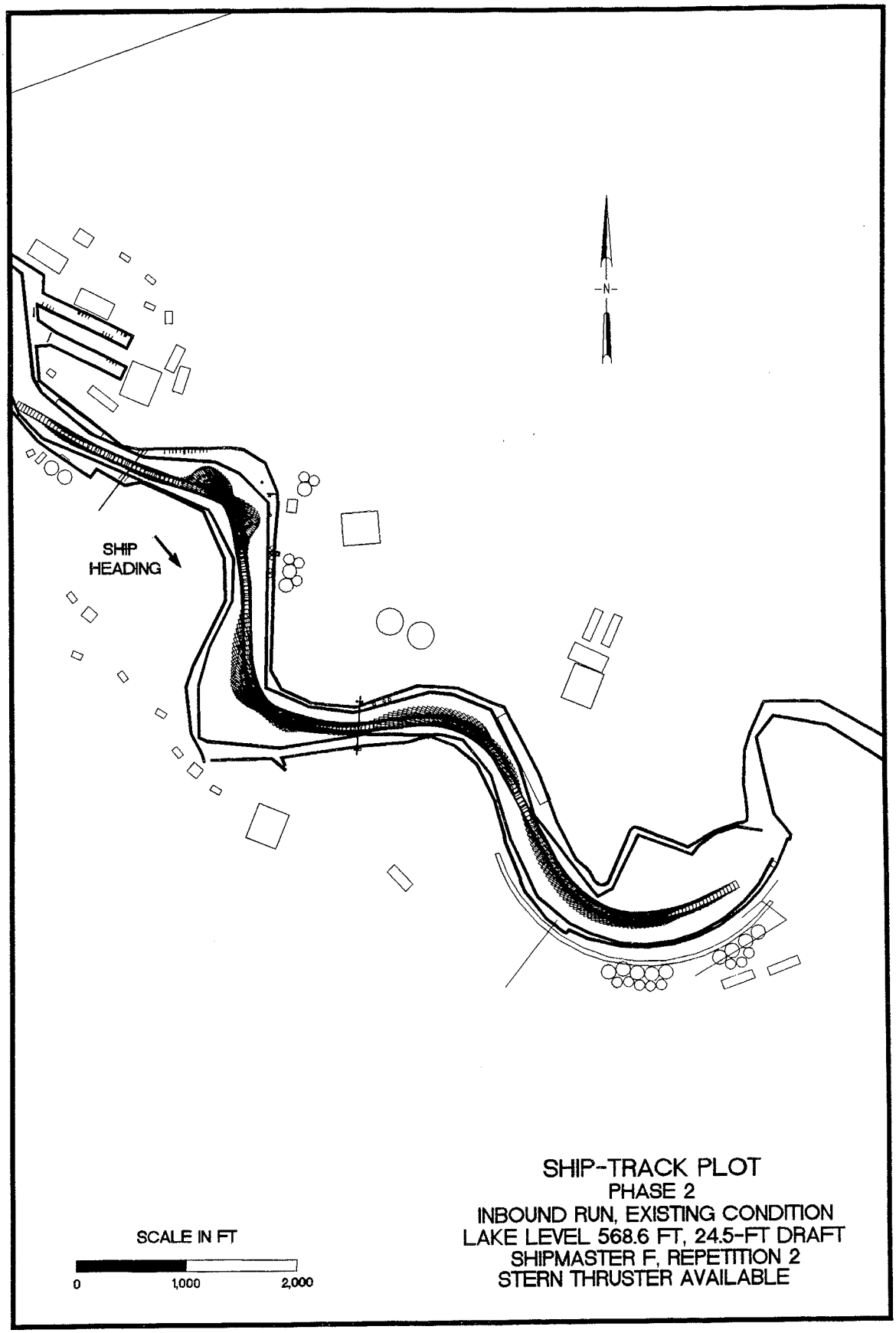
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER E, REPETITION 1
STERN THRUSTER NOT AVAILABLE



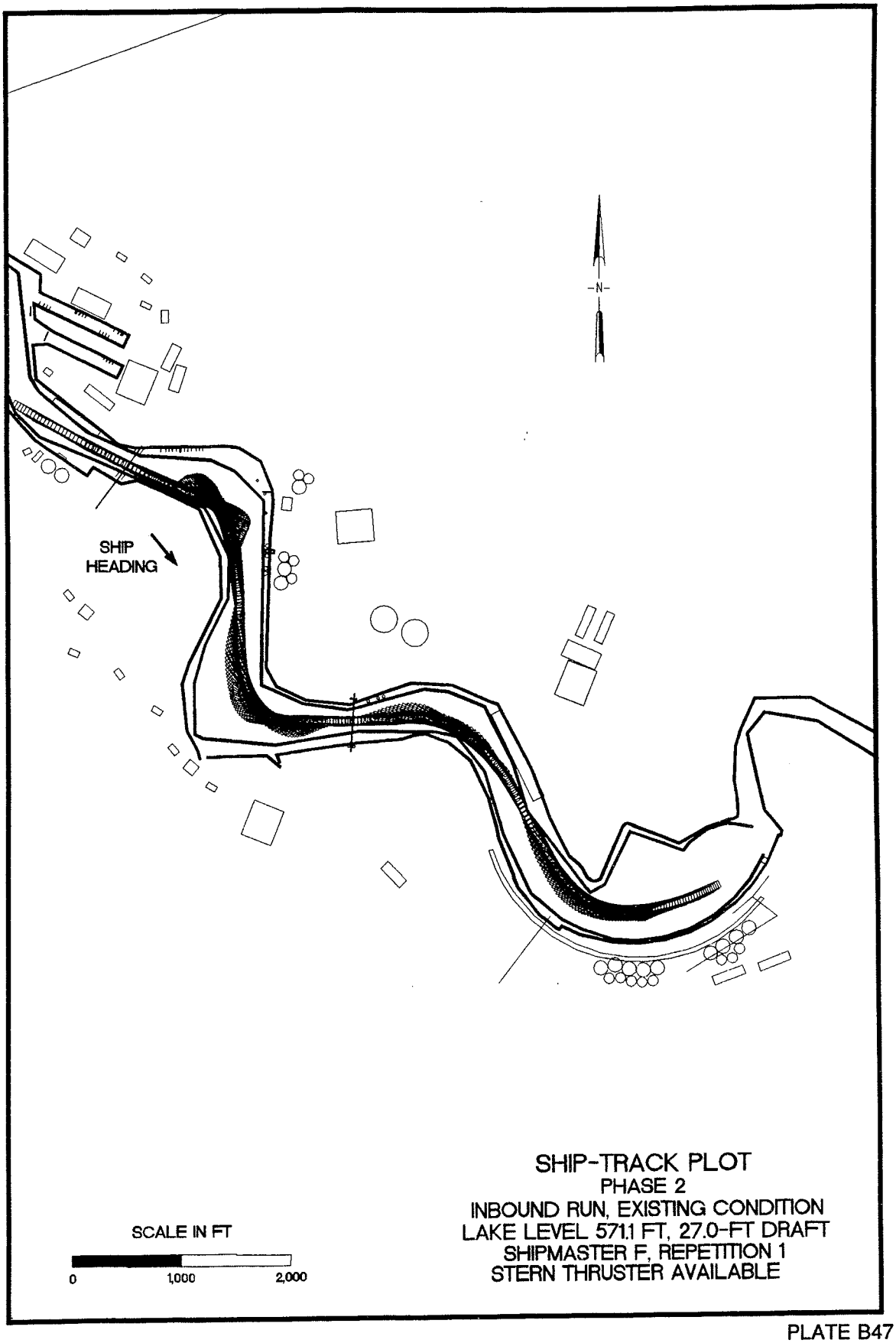
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, EXISTING CONDITION
LAKE LEVEL 571.1 FT, 18.2-FT DRAFT
SHIPMASTER E, REPETITION 1
STERN THRUSTER NOT AVAILABLE



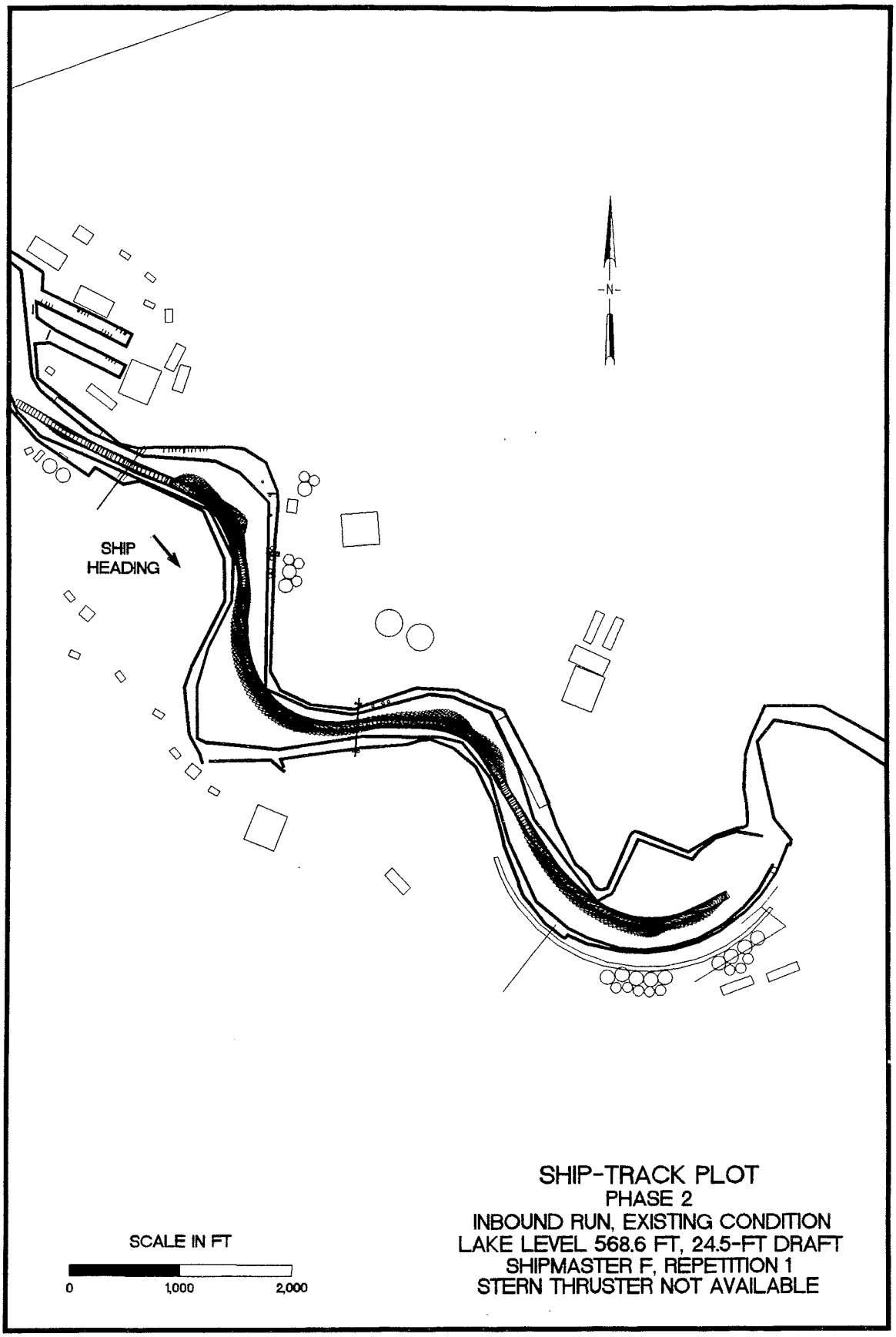
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 24.5-FT DRAFT
SHIPMASTER F, REPETITION 1
STERN THRUSTER AVAILABLE



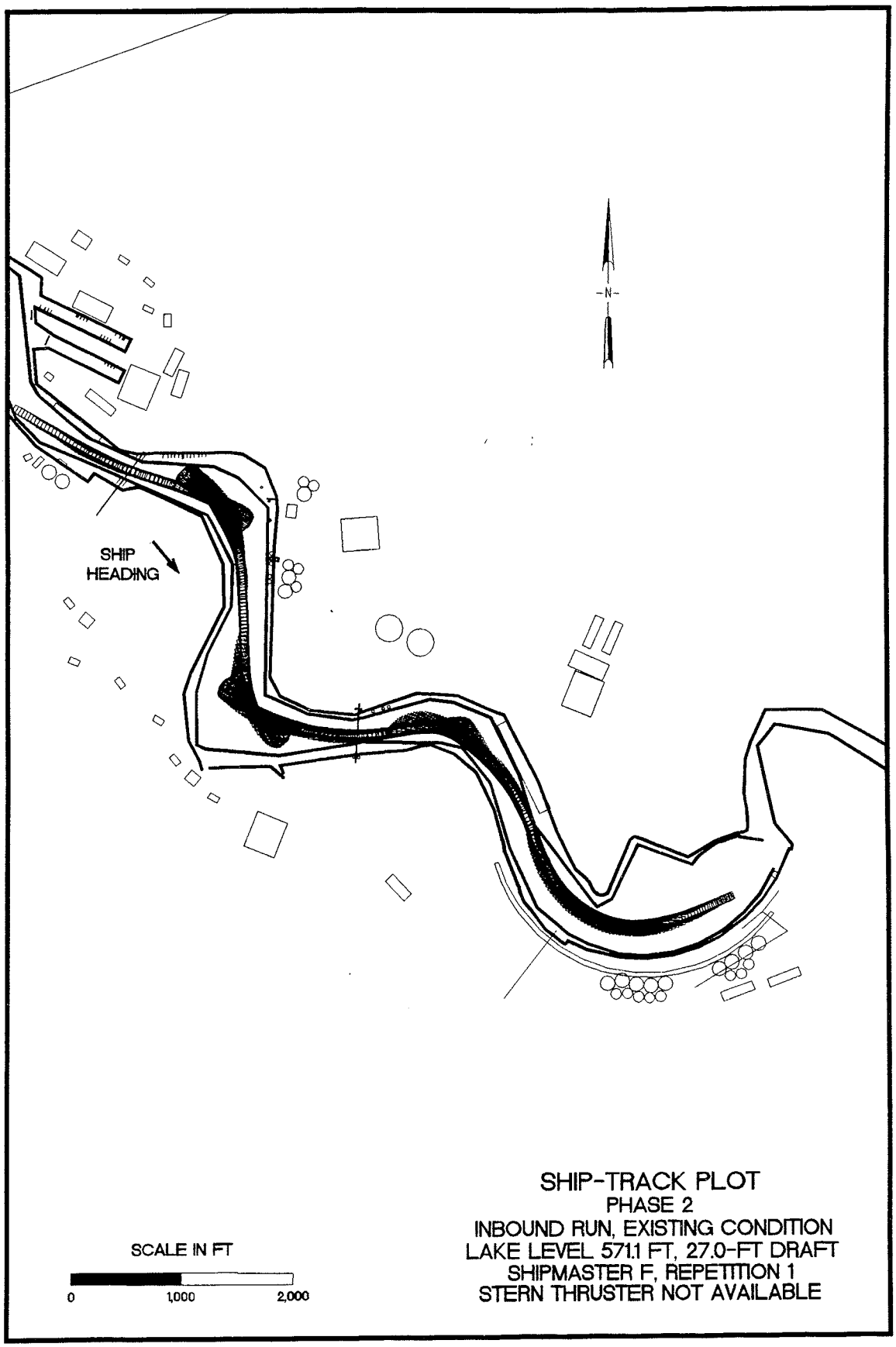
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 24.5-FT DRAFT
SHIPMASTER F, REPETITION 2
STERN THRUSTER AVAILABLE



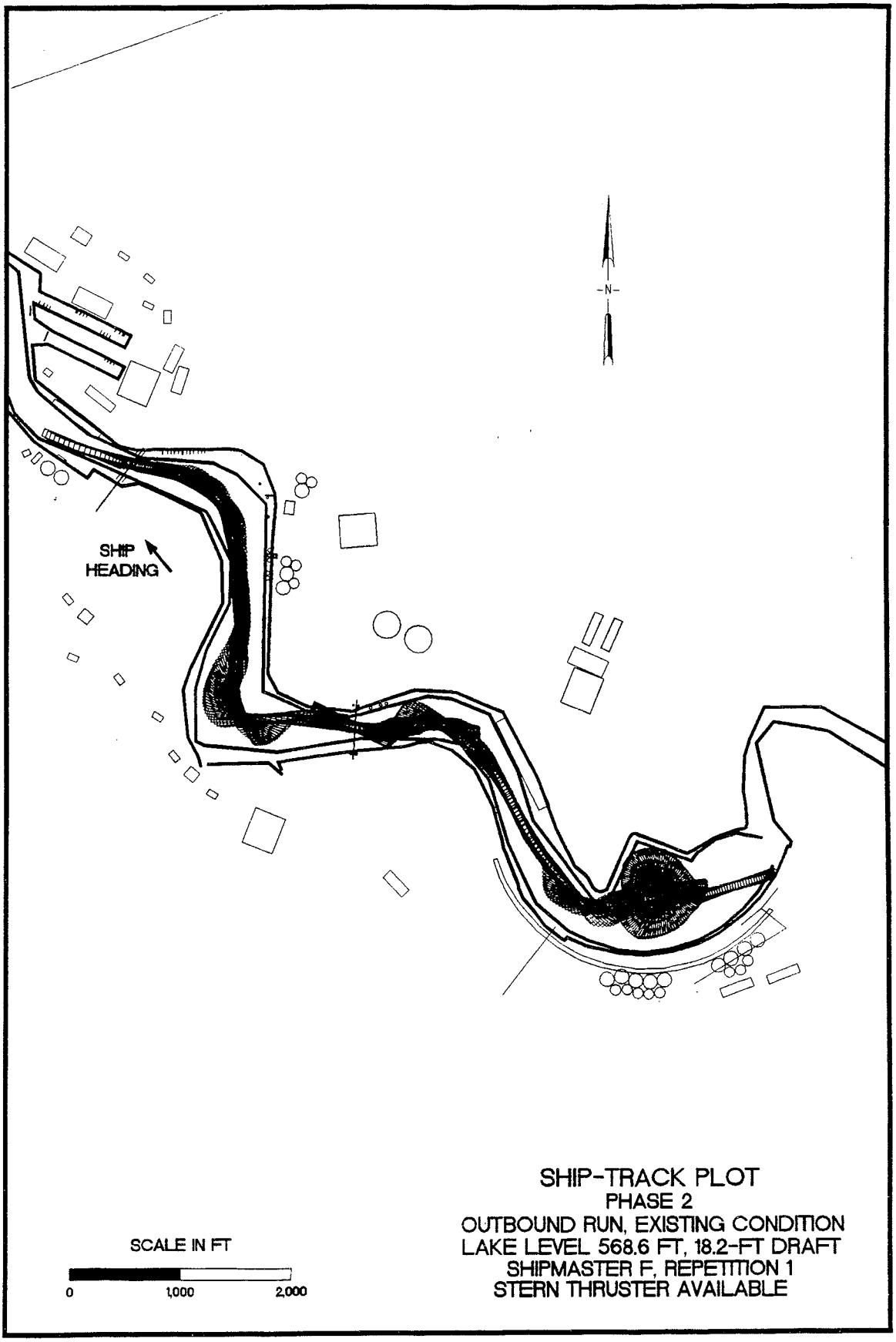
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER F, REPETITION 1
STERN THRUSTER AVAILABLE



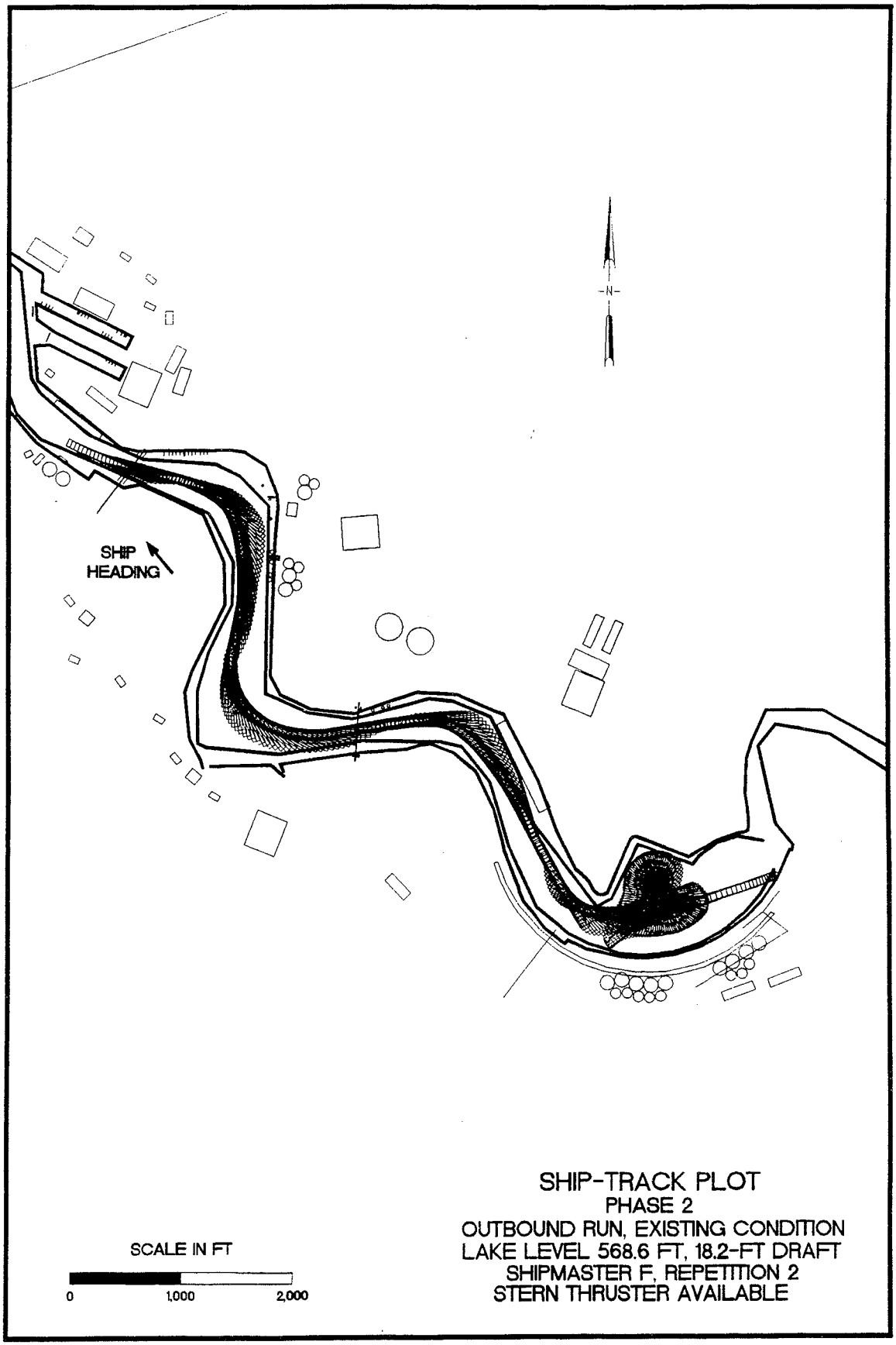
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 24.5-FT DRAFT
SHIPMASTER F, REPETITION 1
STERN THRUSTER NOT AVAILABLE



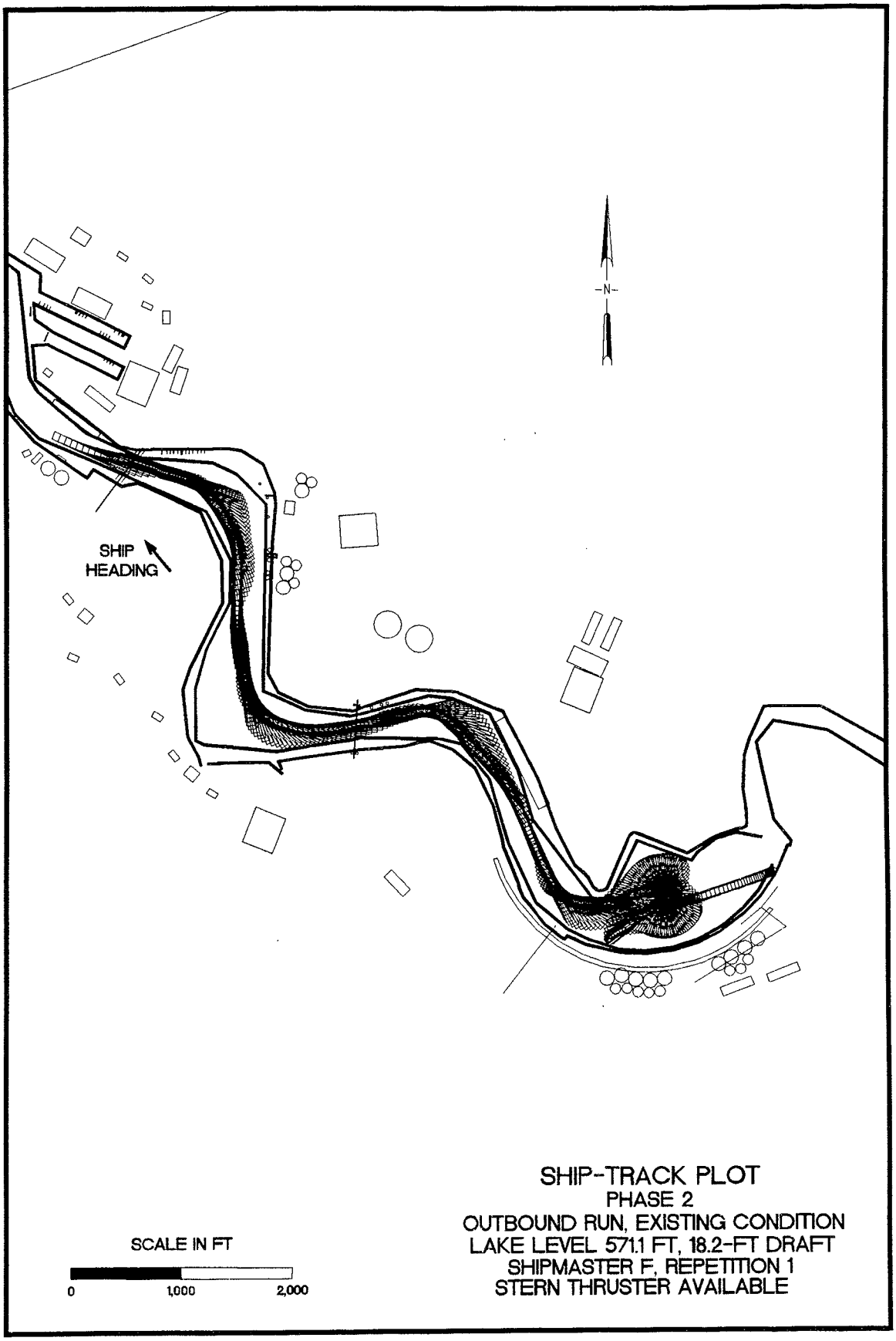
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, EXISTING CONDITION
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER F, REPETITION 1
STERN THRUSTER NOT AVAILABLE



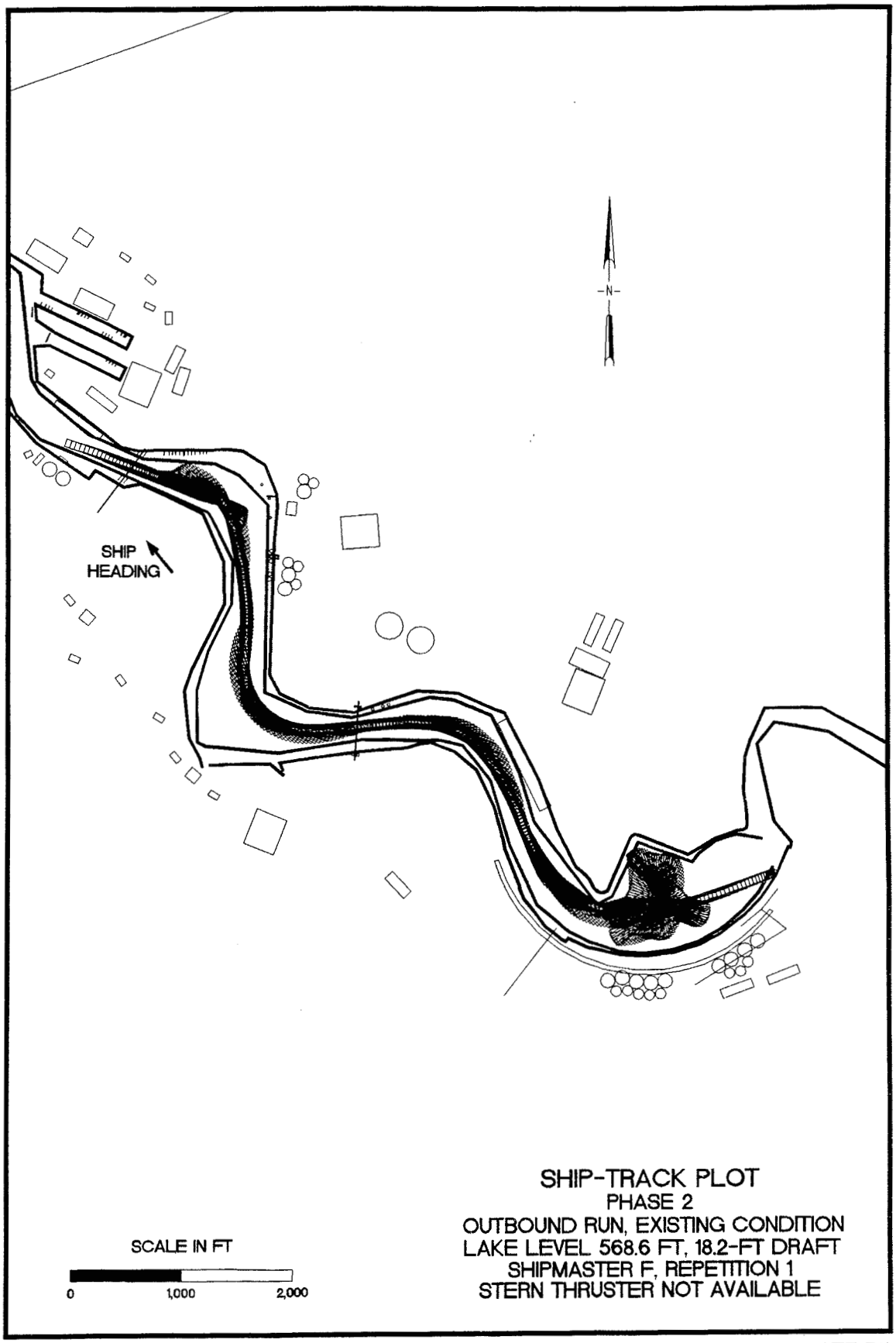
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER F, REPETITION 1
STERN THRUSTER AVAILABLE



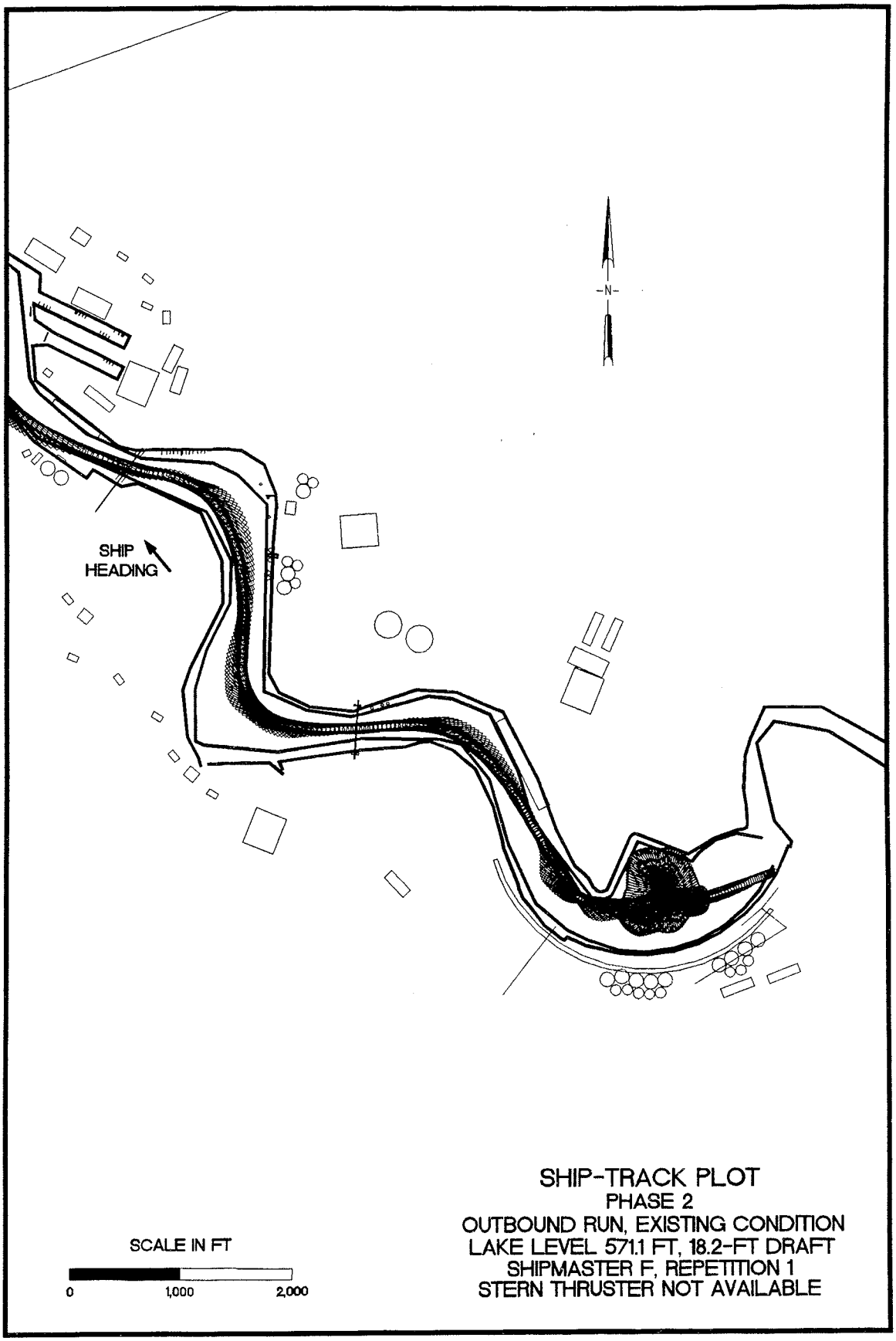
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER F, REPETITION 2
STERN THRUSTER AVAILABLE



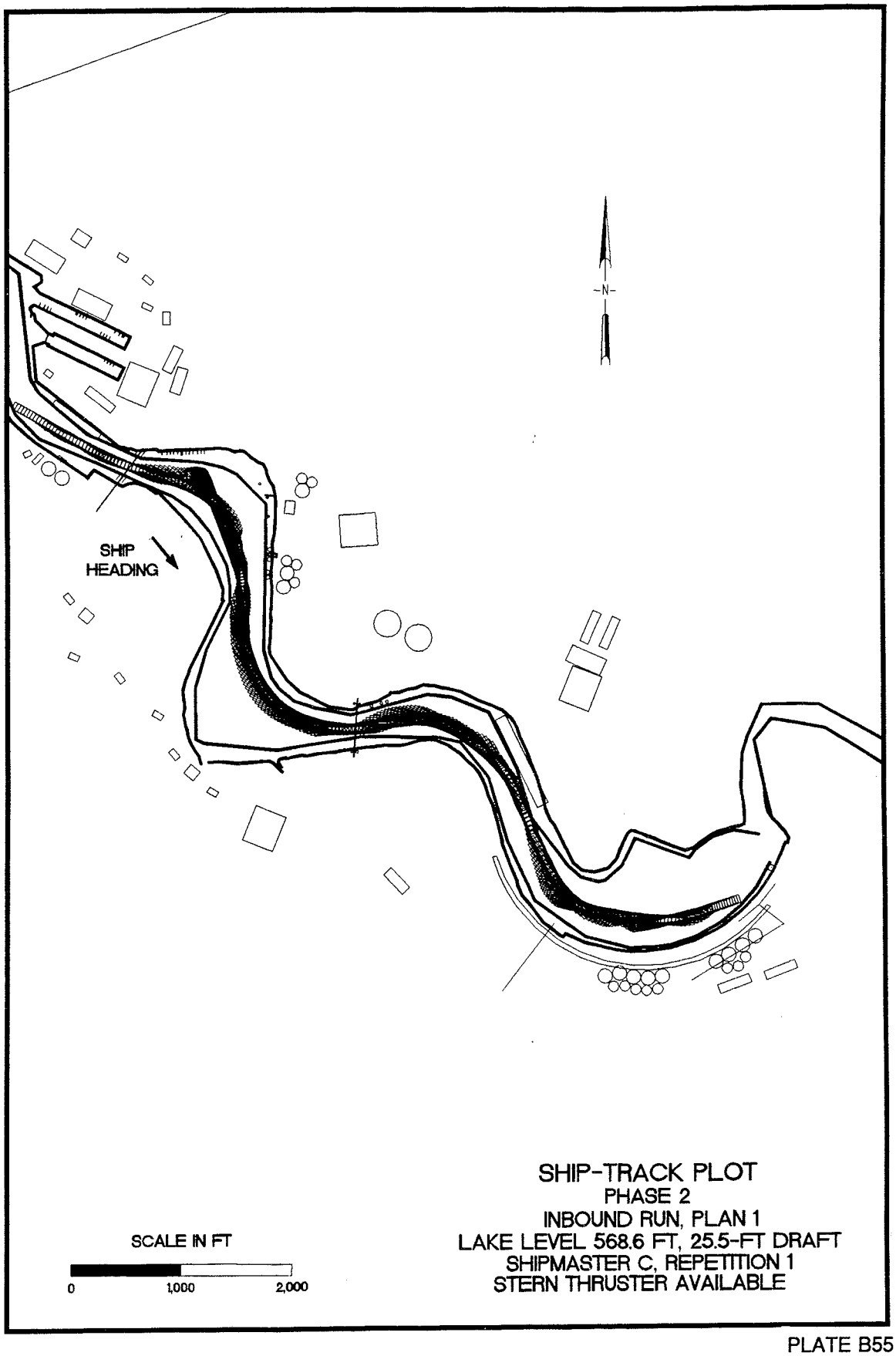
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, EXISTING CONDITION
LAKE LEVEL 571.1 FT, 18.2-FT DRAFT
SHIPMASTER F, REPETITION 1
STERN THRUSTER AVAILABLE



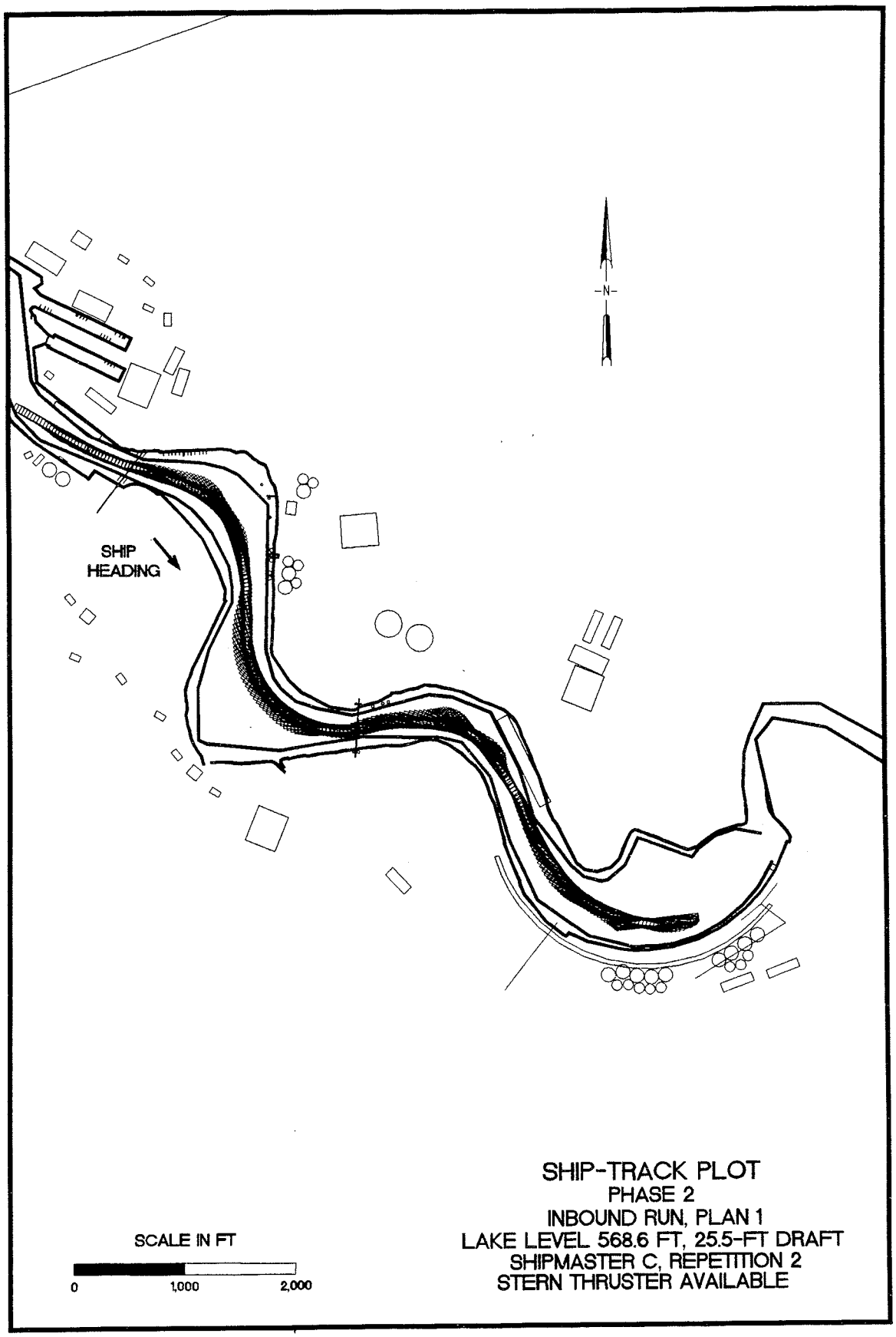
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, EXISTING CONDITION
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER F, REPETITION 1
STERN THRUSTER NOT AVAILABLE



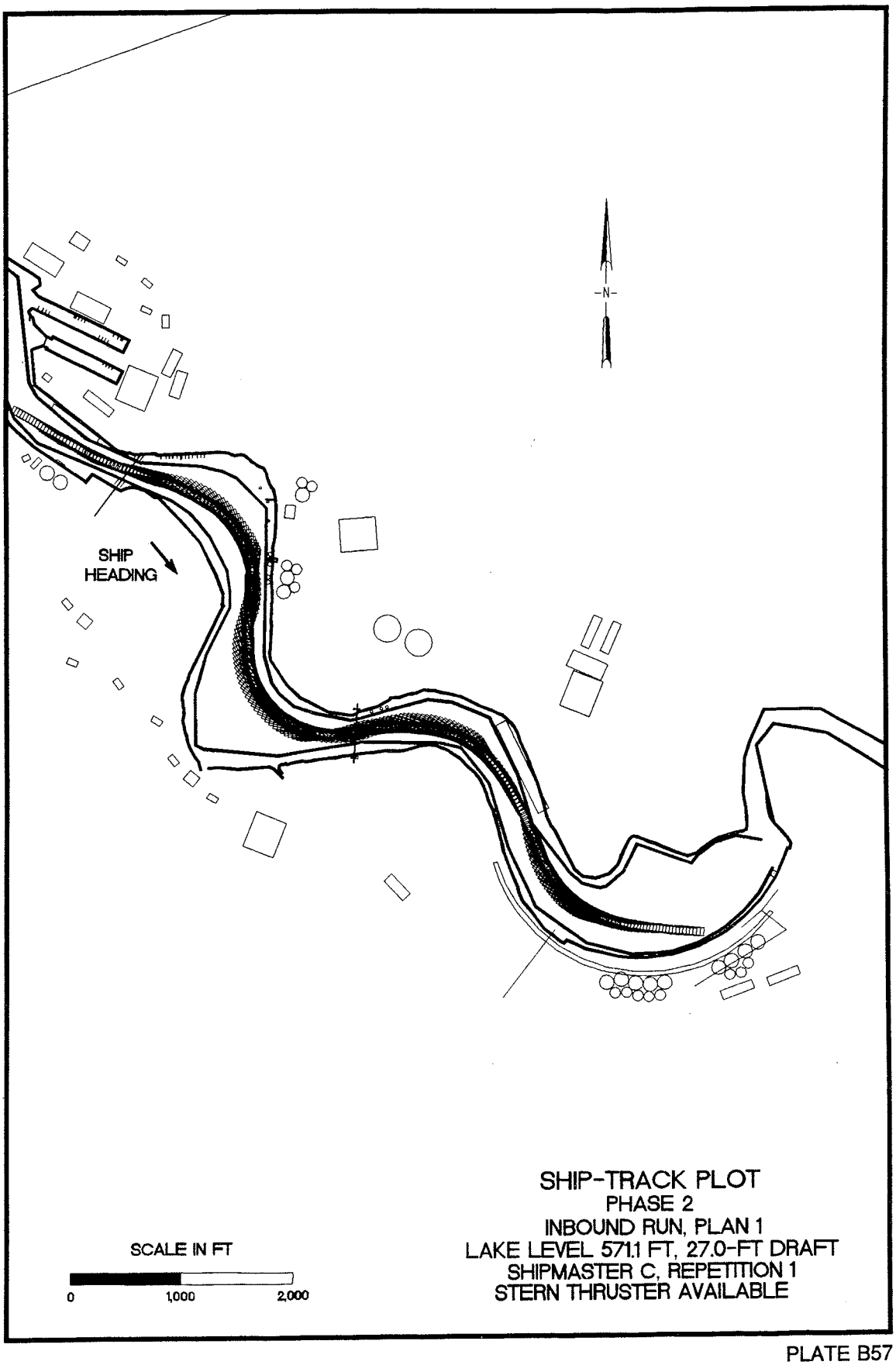
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, EXISTING CONDITION
LAKE LEVEL 571.1 FT, 18.2-FT DRAFT
SHIPMASTER F, REPETITION 1
STERN THRUSTER NOT AVAILABLE



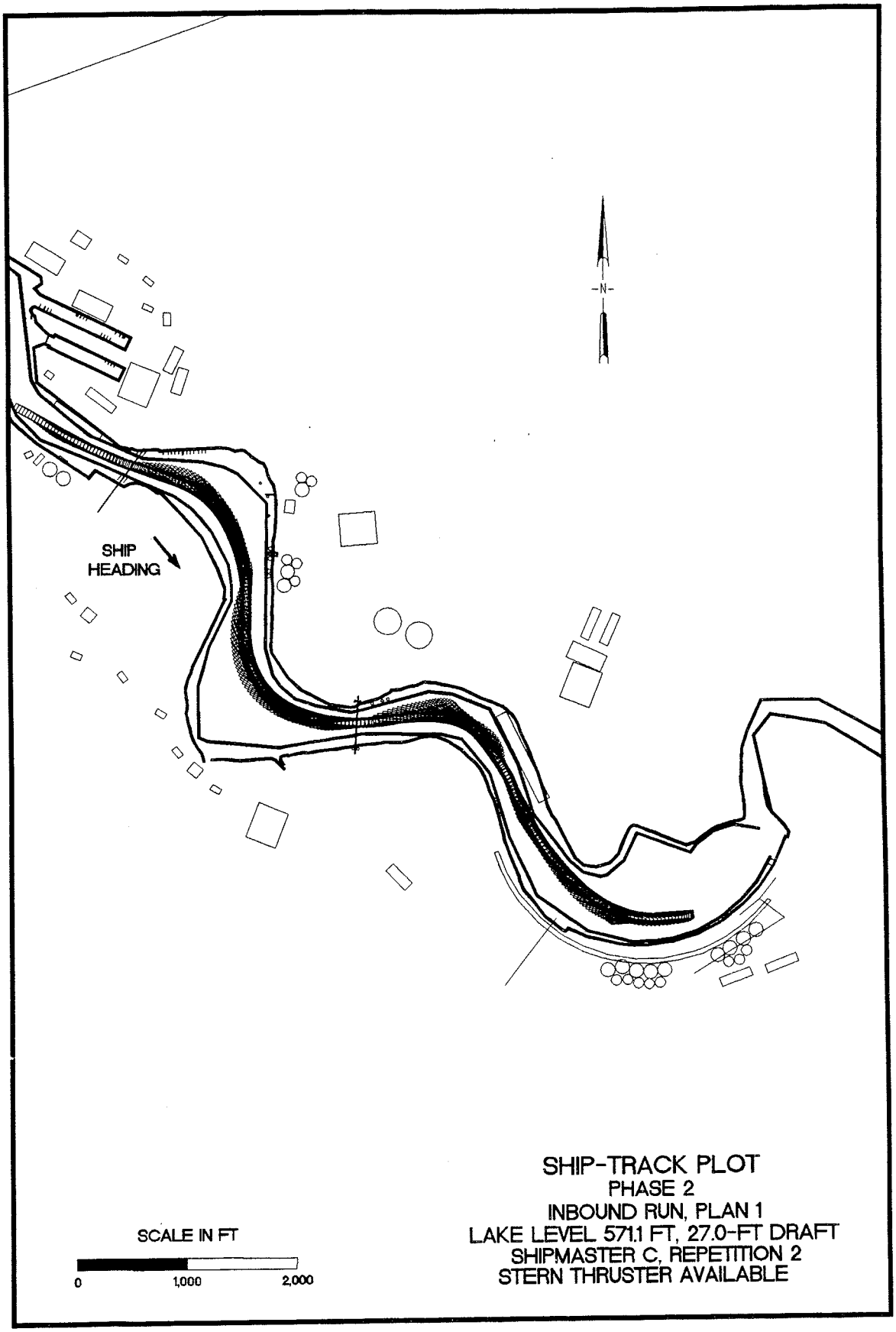
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 1
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER C, REPETITION 1
STERN THRUSTER AVAILABLE



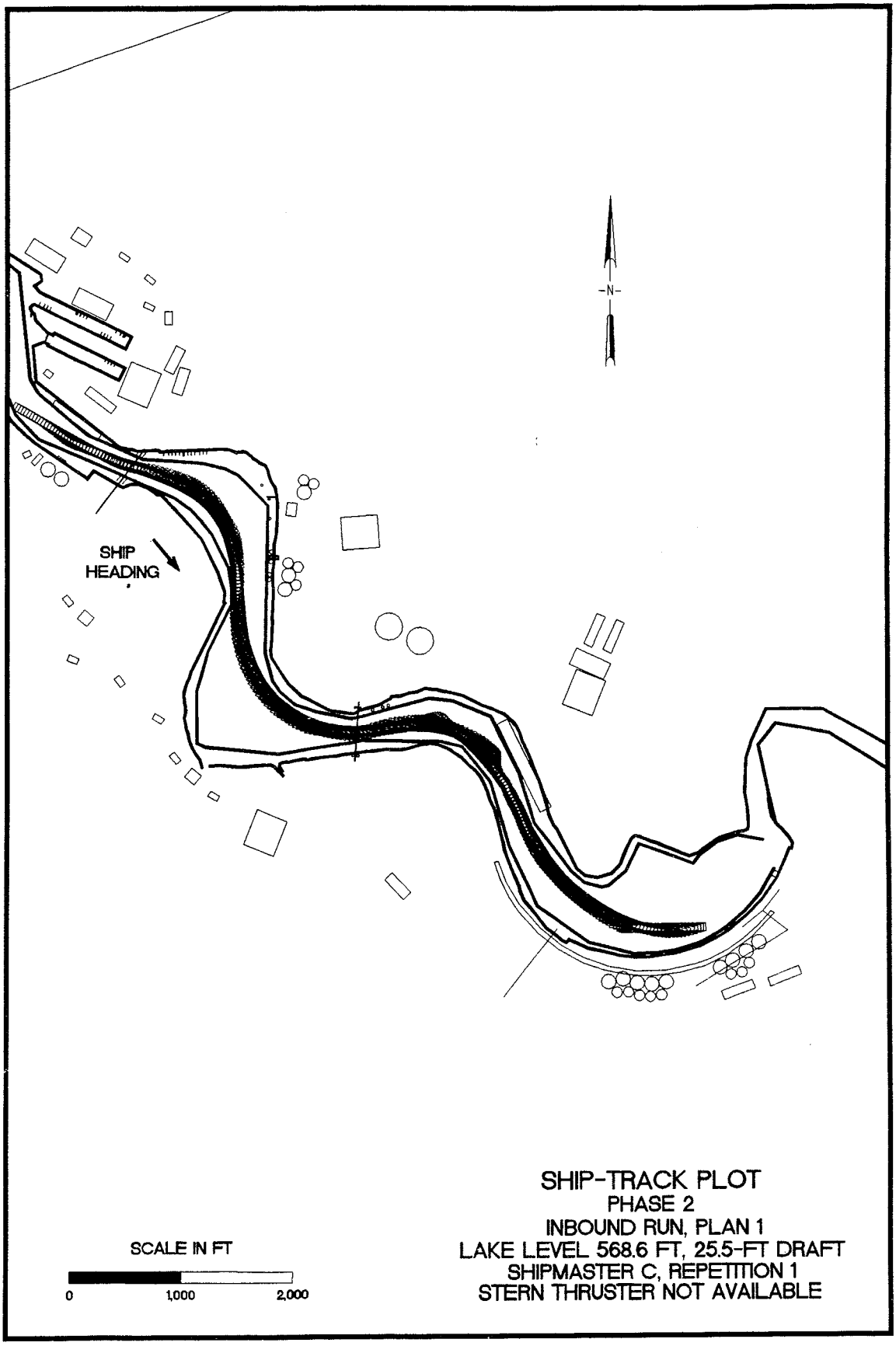
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 1
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER C, REPETITION 2
STERN THRUSTER AVAILABLE



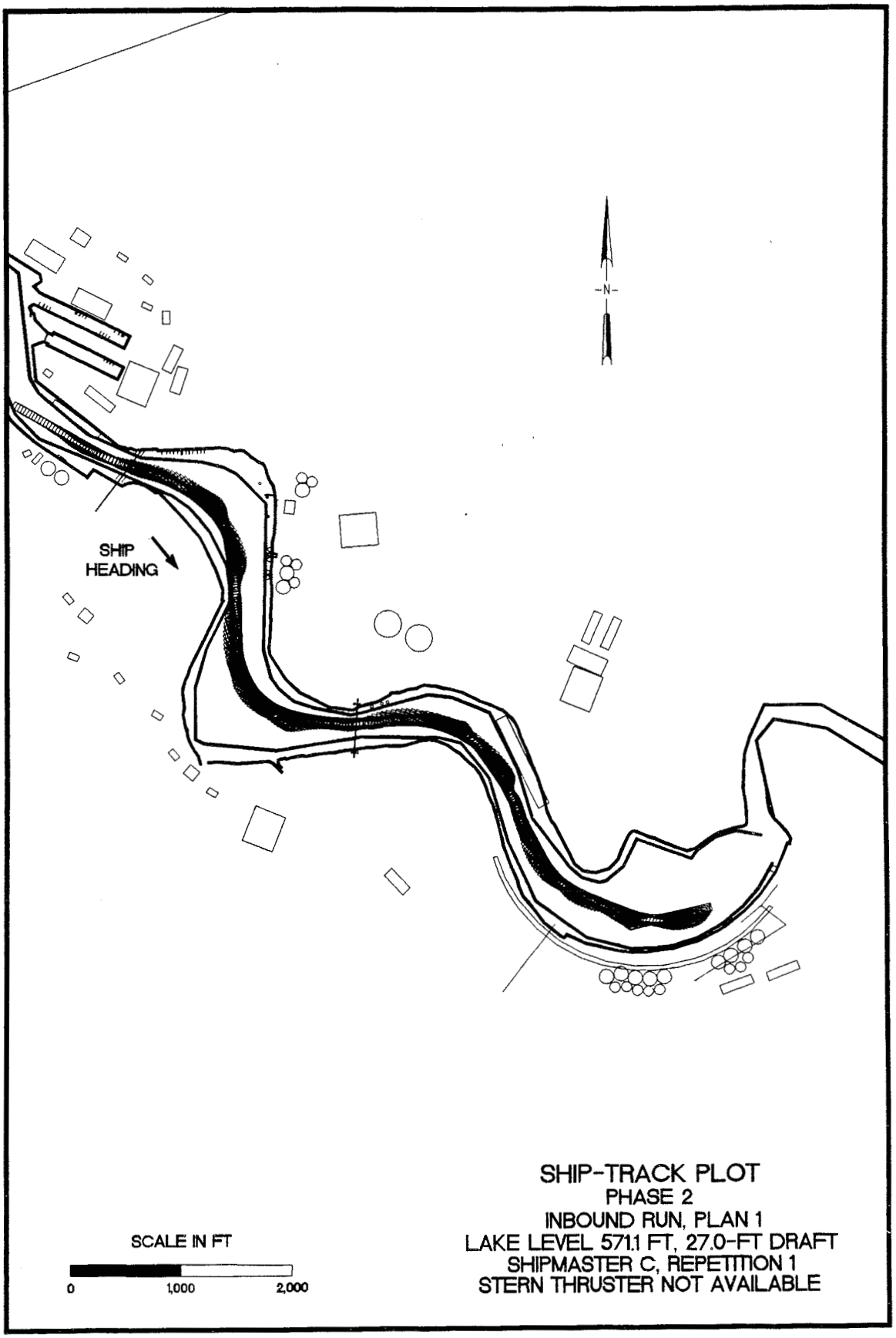
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 1
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER C, REPETITION 1
STERN THRUSTER AVAILABLE



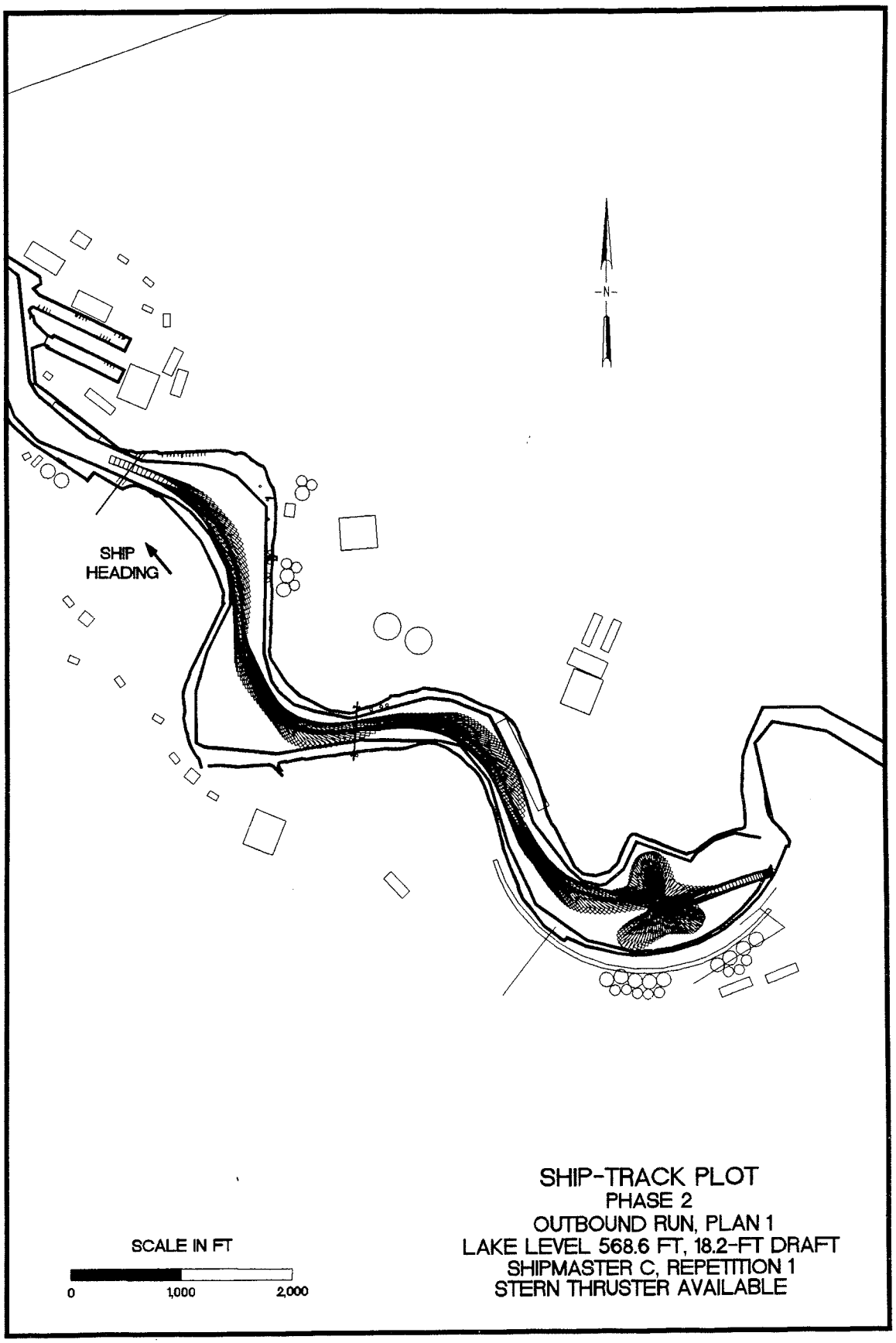
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 1
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER C, REPETITION 2
STERN THRUSTER AVAILABLE



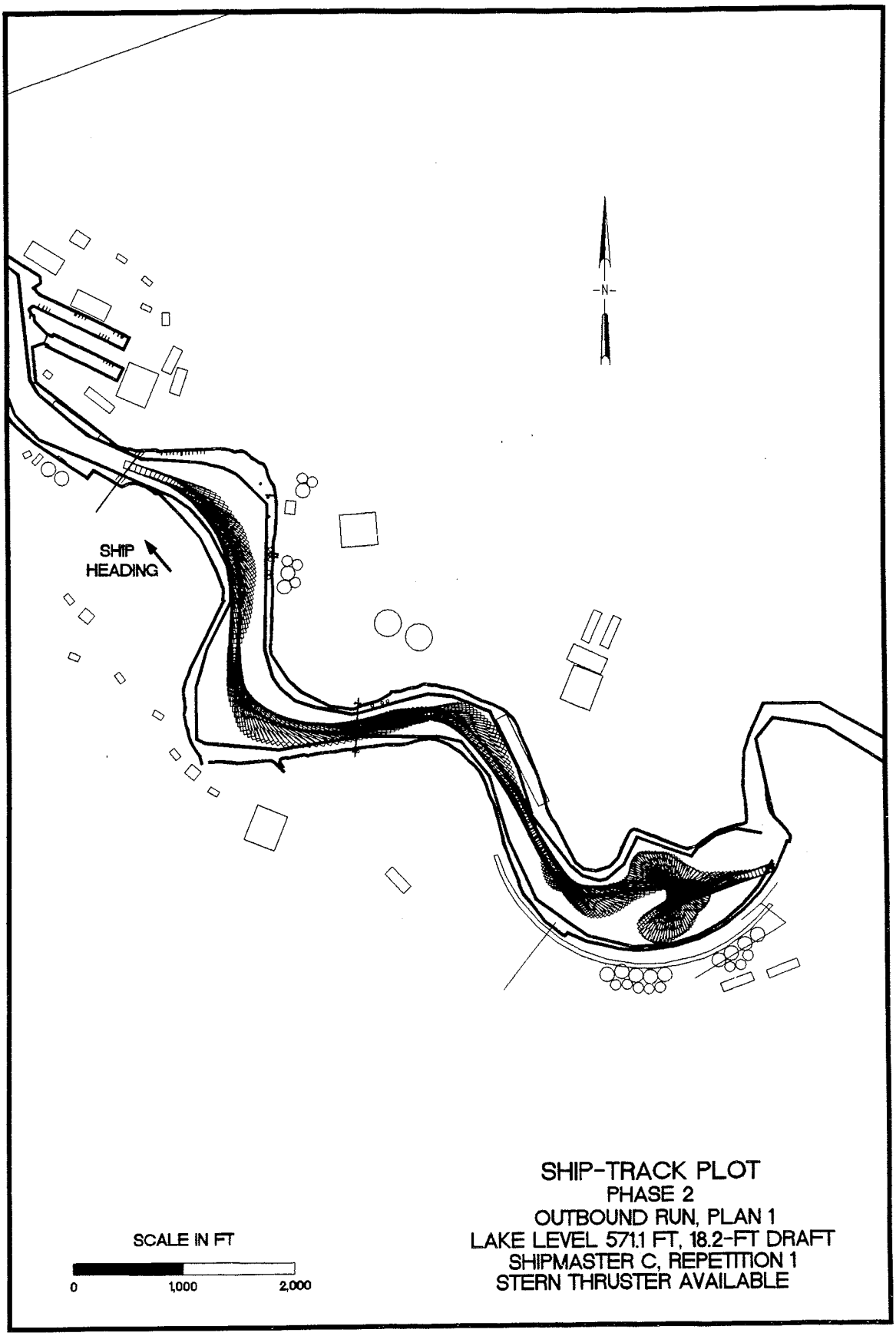
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 1
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER C, REPETITION 1
STERN THRUSTER NOT AVAILABLE



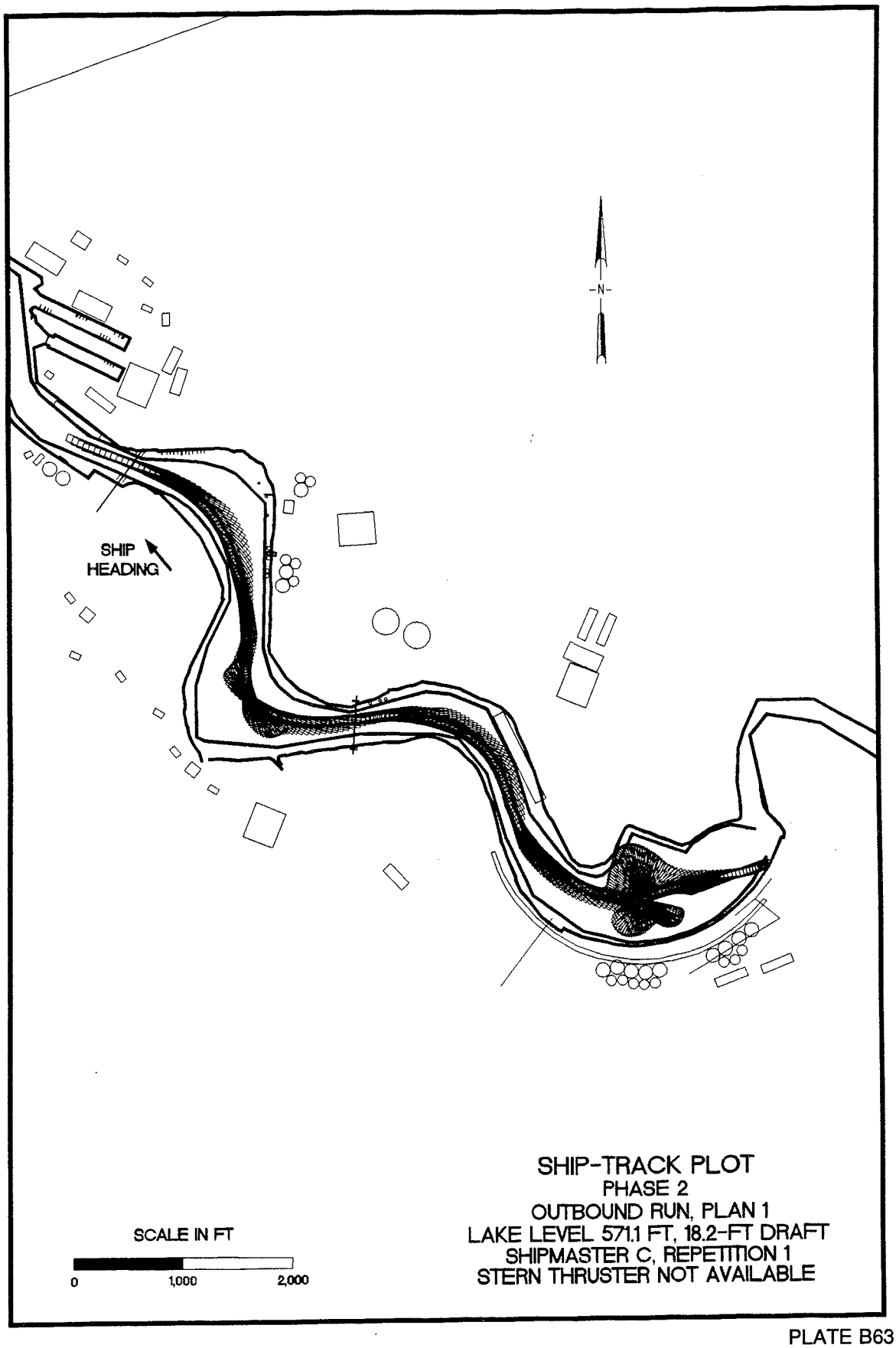
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 1
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER C, REPETITION 1
STERN THRUSTER NOT AVAILABLE



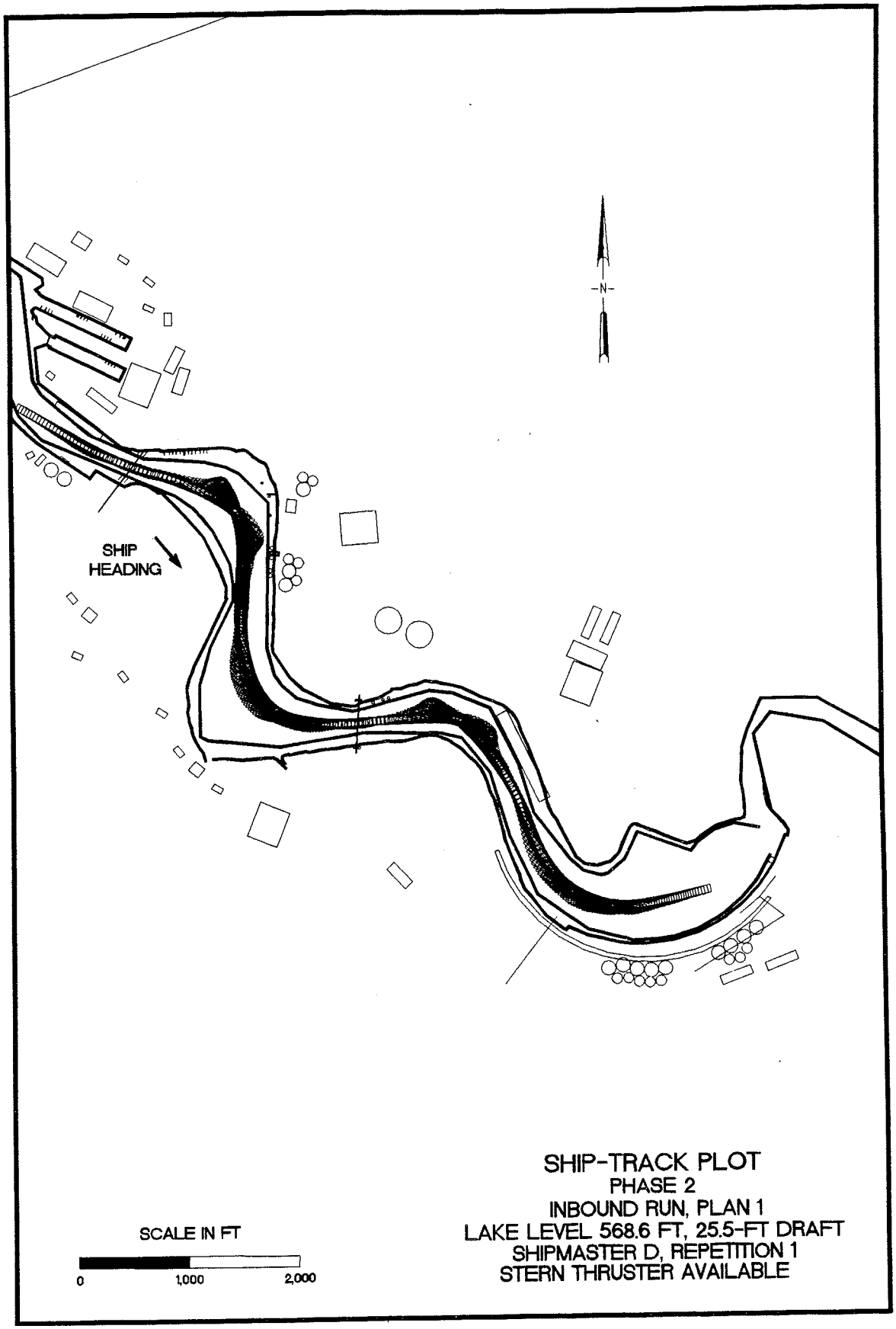
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 1
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER C, REPETITION 1
STERN THRUSTER AVAILABLE



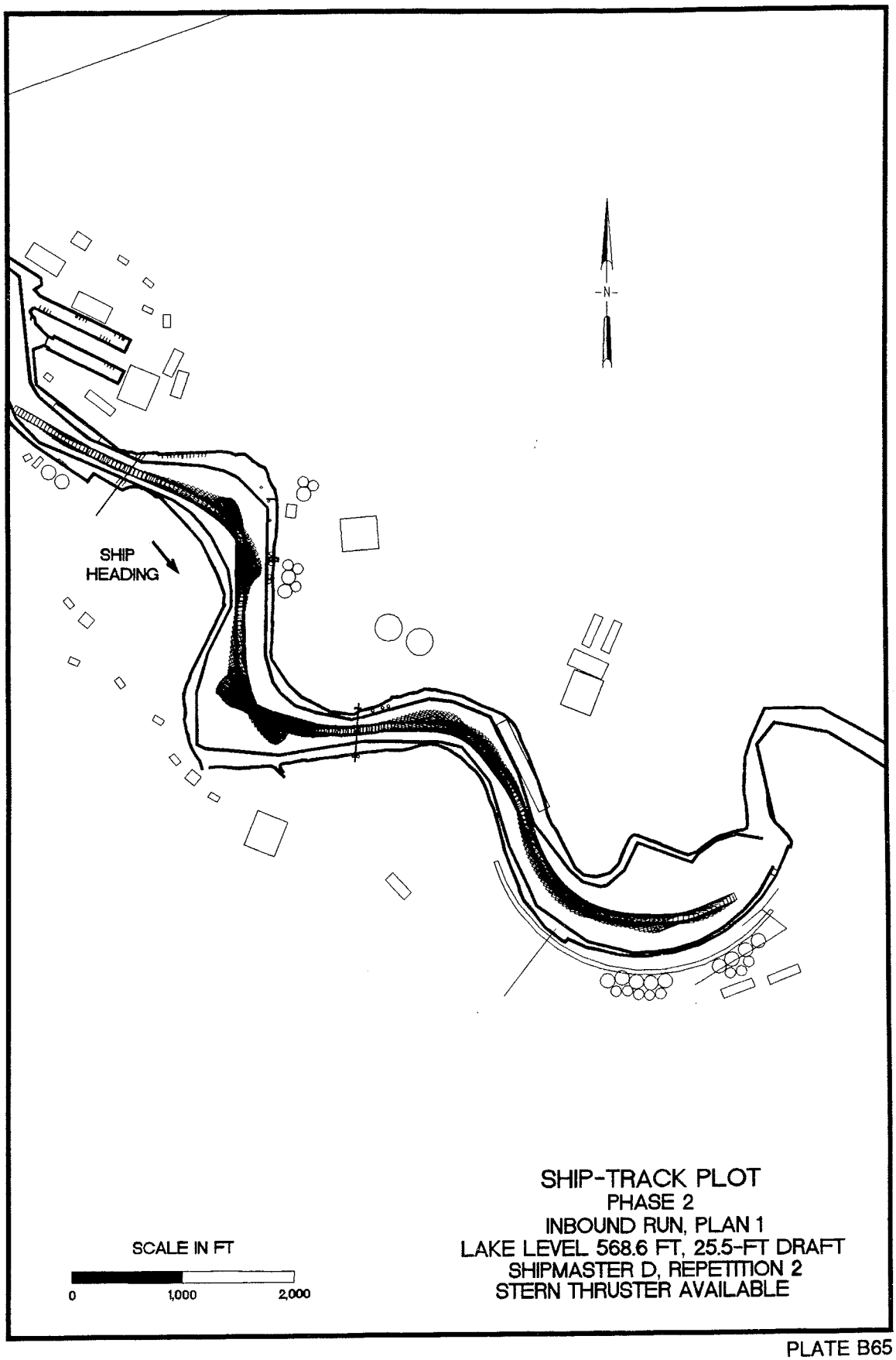
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 1
LAKE LEVEL 571.1 FT, 18.2-FT DRAFT
SHIPMASTER C, REPETITION 1
STERN THRUSTER AVAILABLE



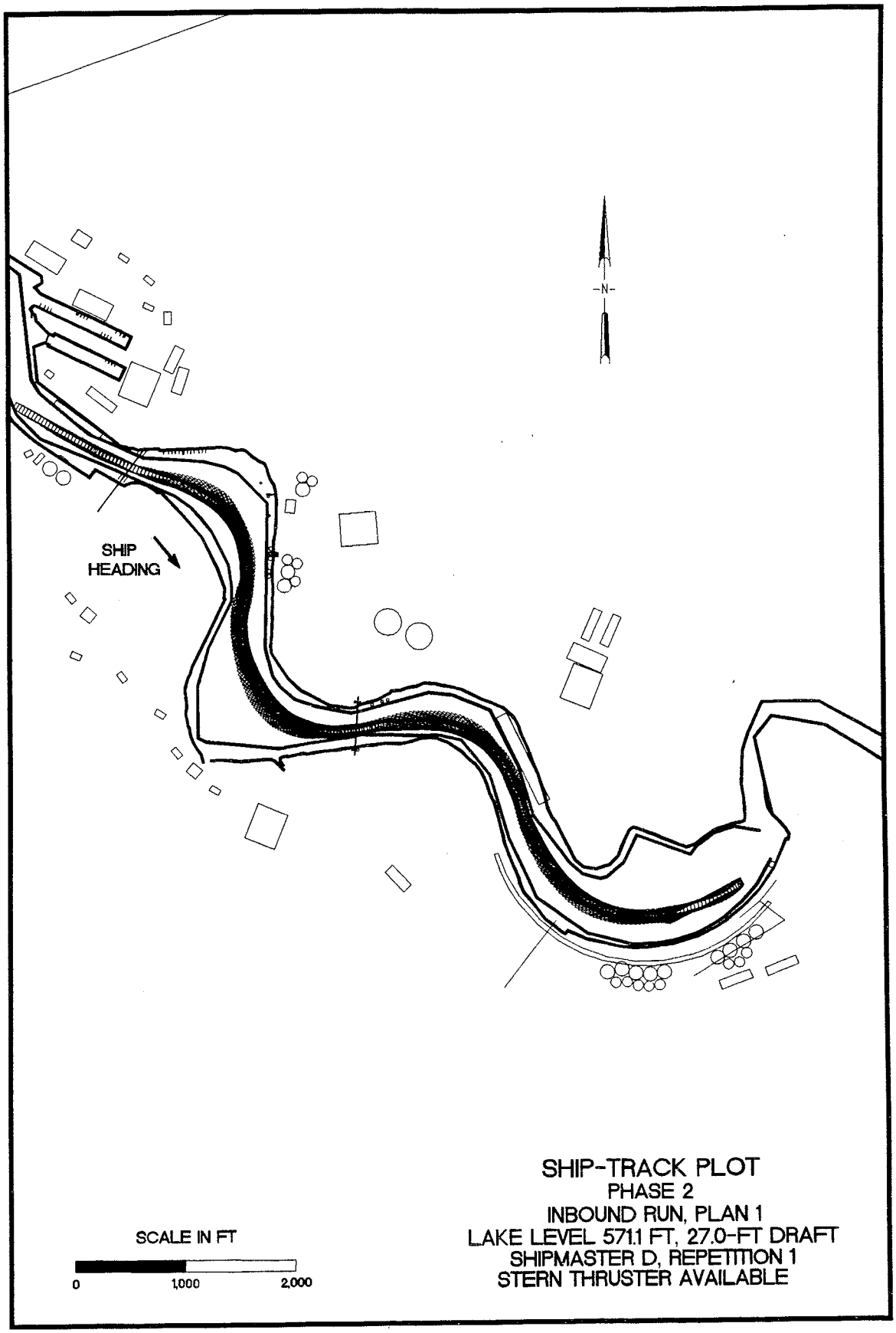
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 1
LAKE LEVEL 571.1 FT, 18.2-FT DRAFT
SHIPMASTER C, REPETITION 1
STERN THRUSTER NOT AVAILABLE



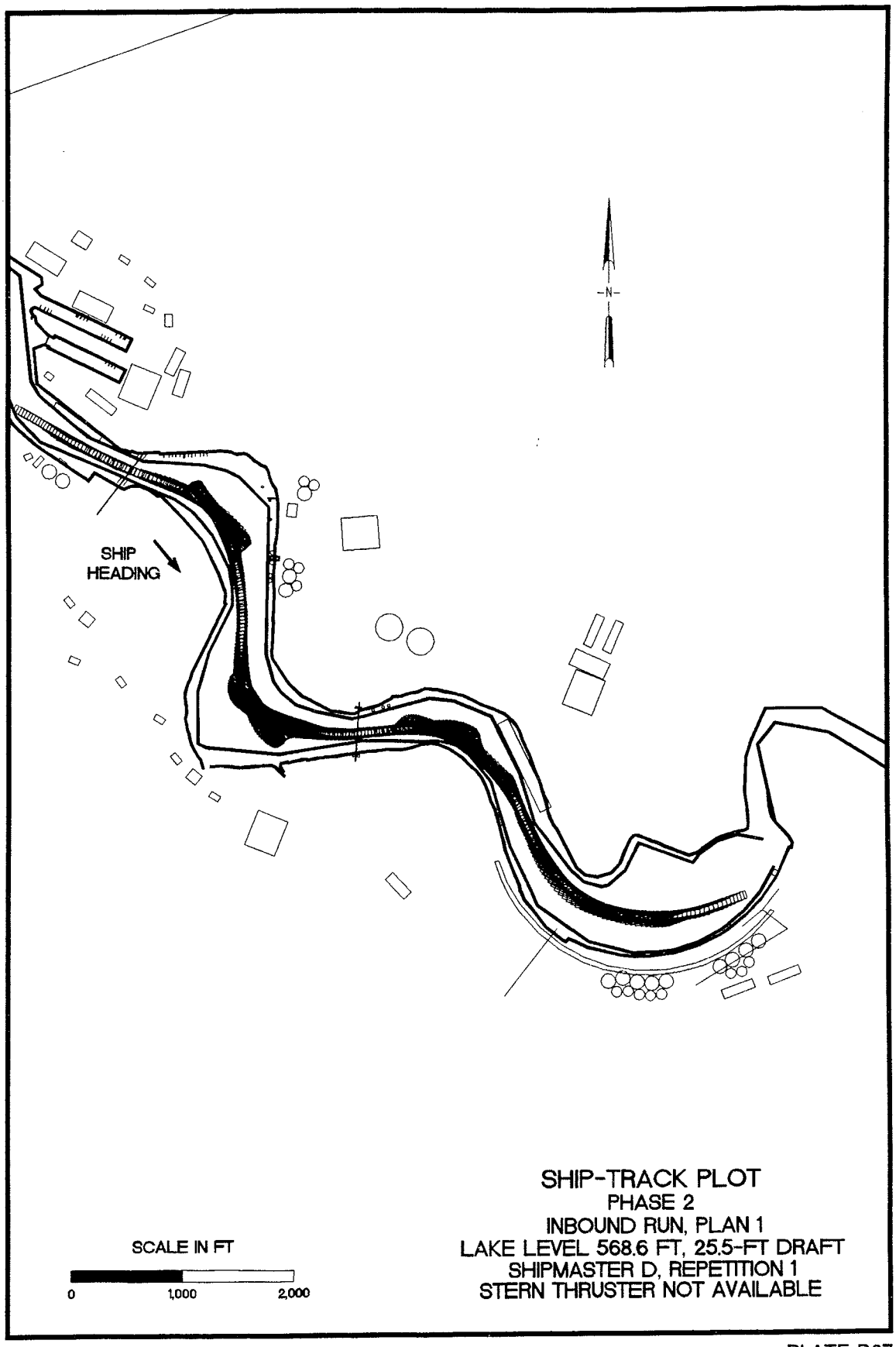
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 1
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER D, REPETITION 1
STERN THRUSTER AVAILABLE



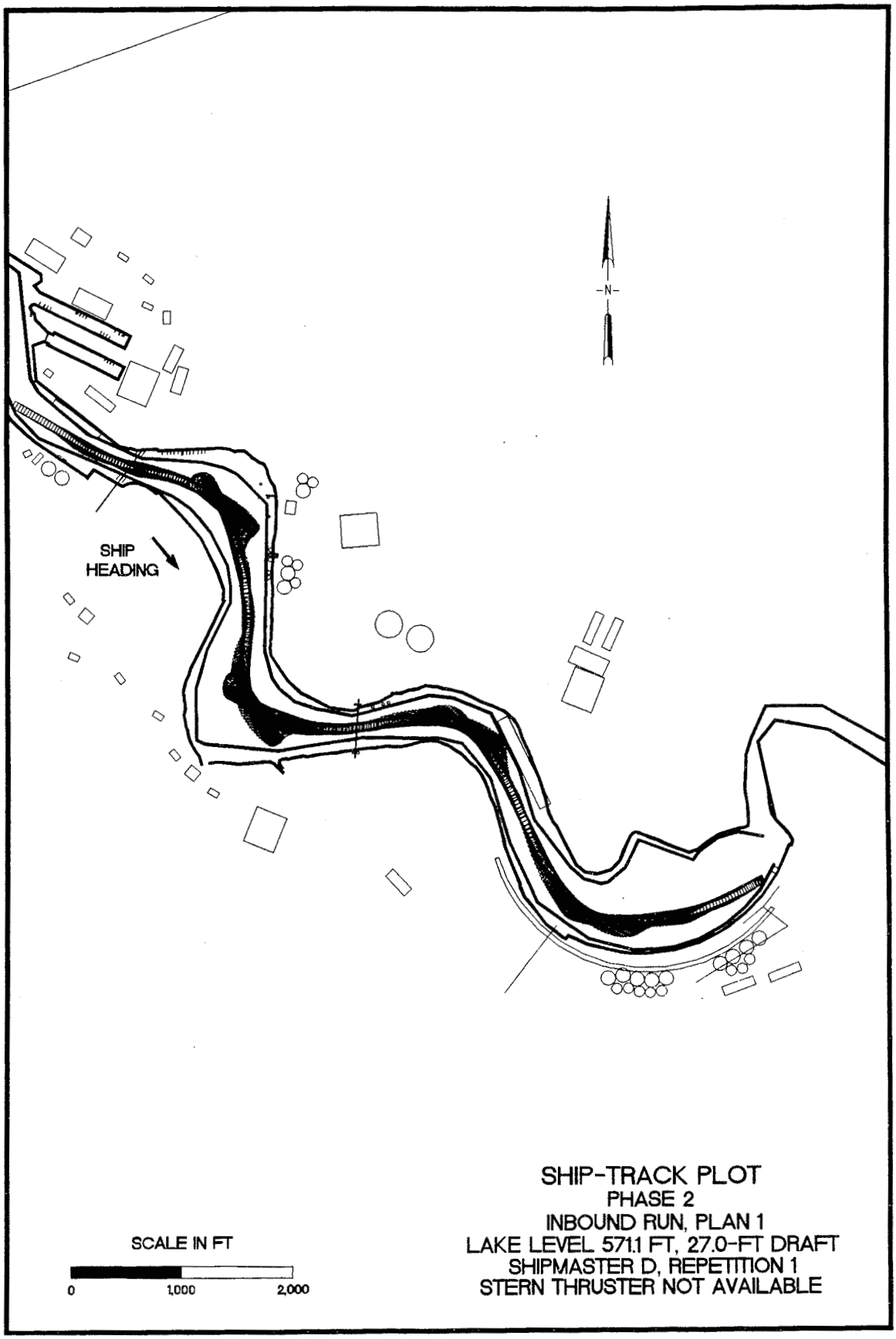
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 1
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER D, REPETITION 2
STERN THRUSTER AVAILABLE



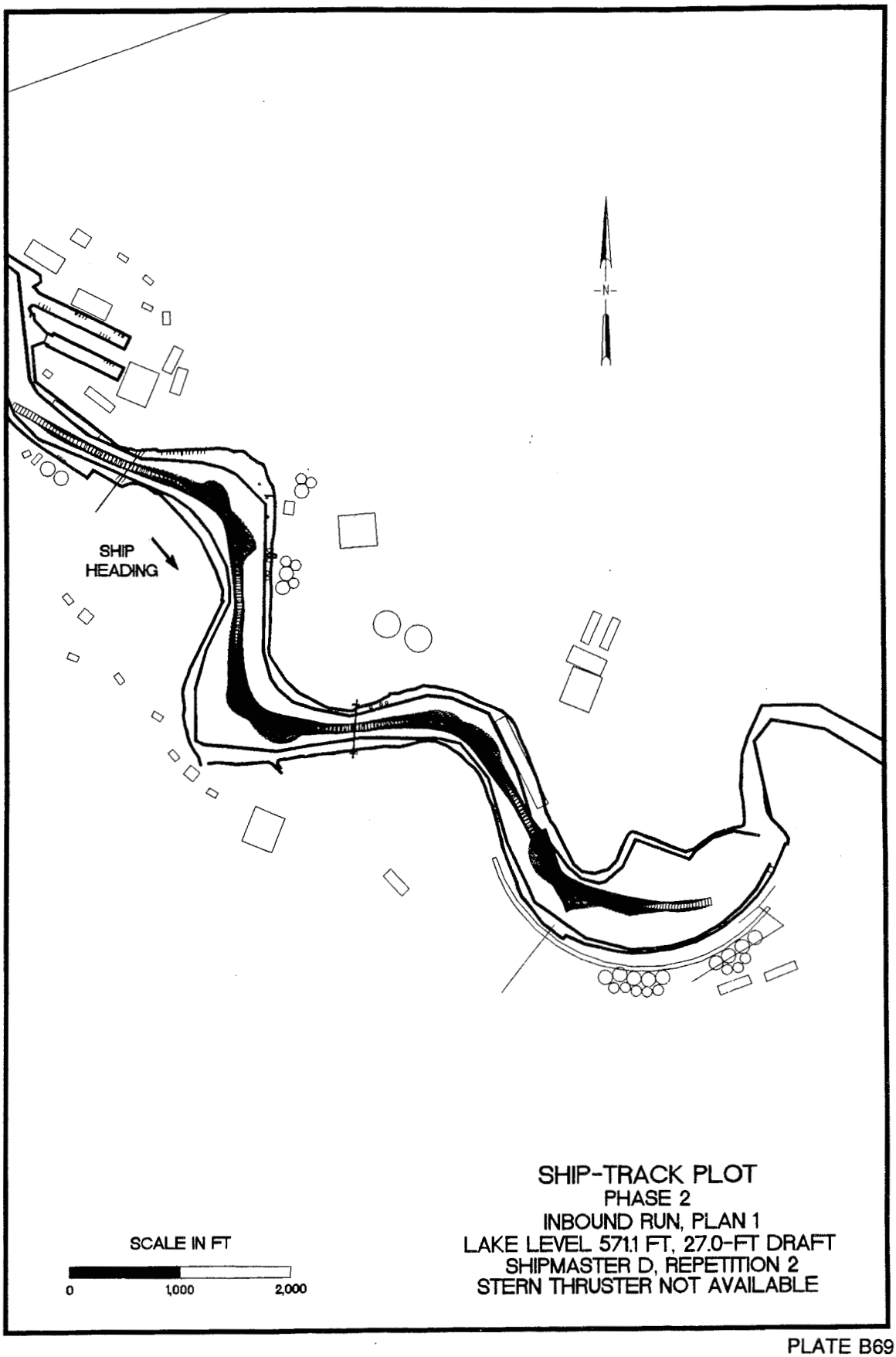
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 1
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER D, REPETITION 1
STERN THRUSTER AVAILABLE



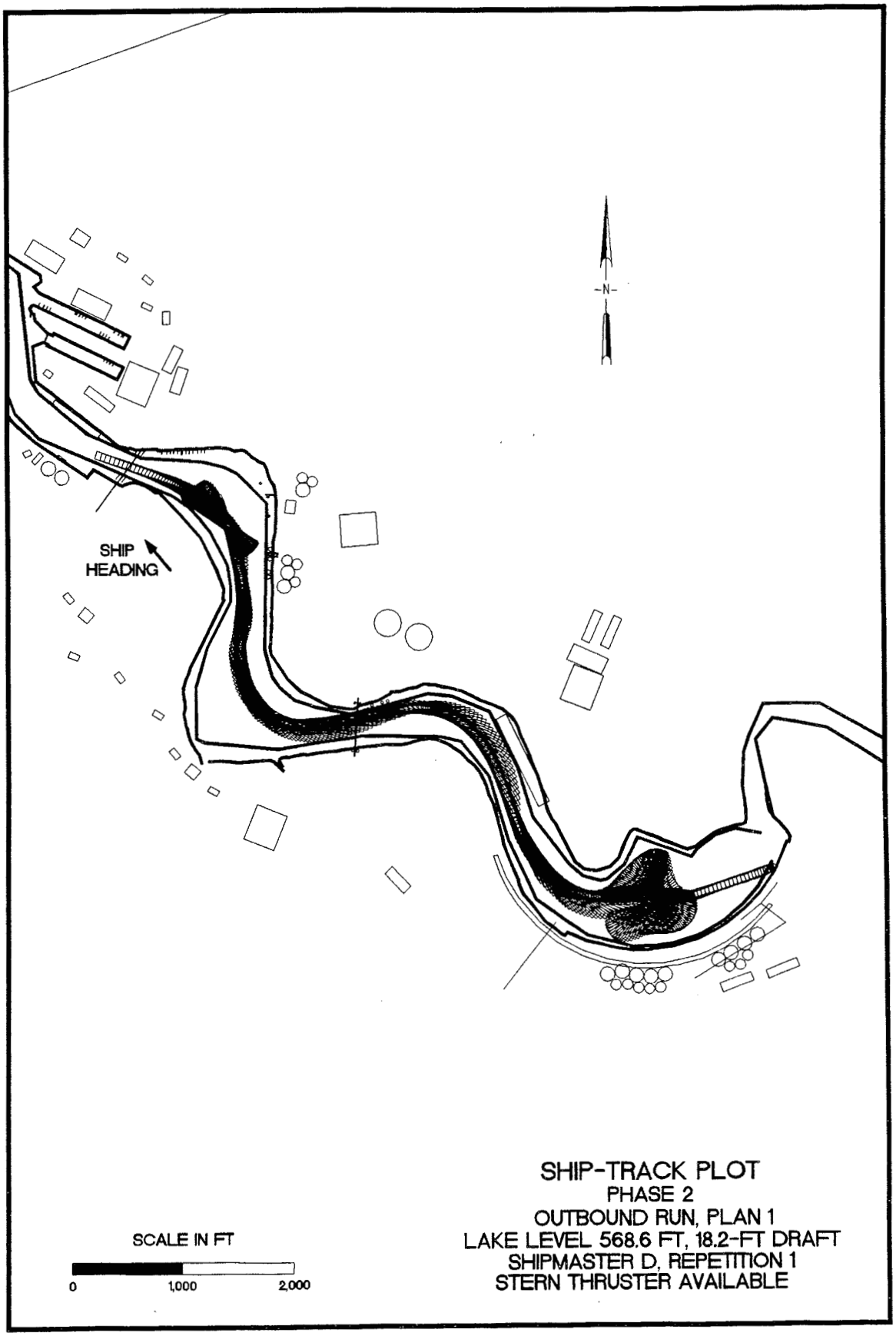
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 1
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER D, REPETITION 1
STERN THRUSTER NOT AVAILABLE



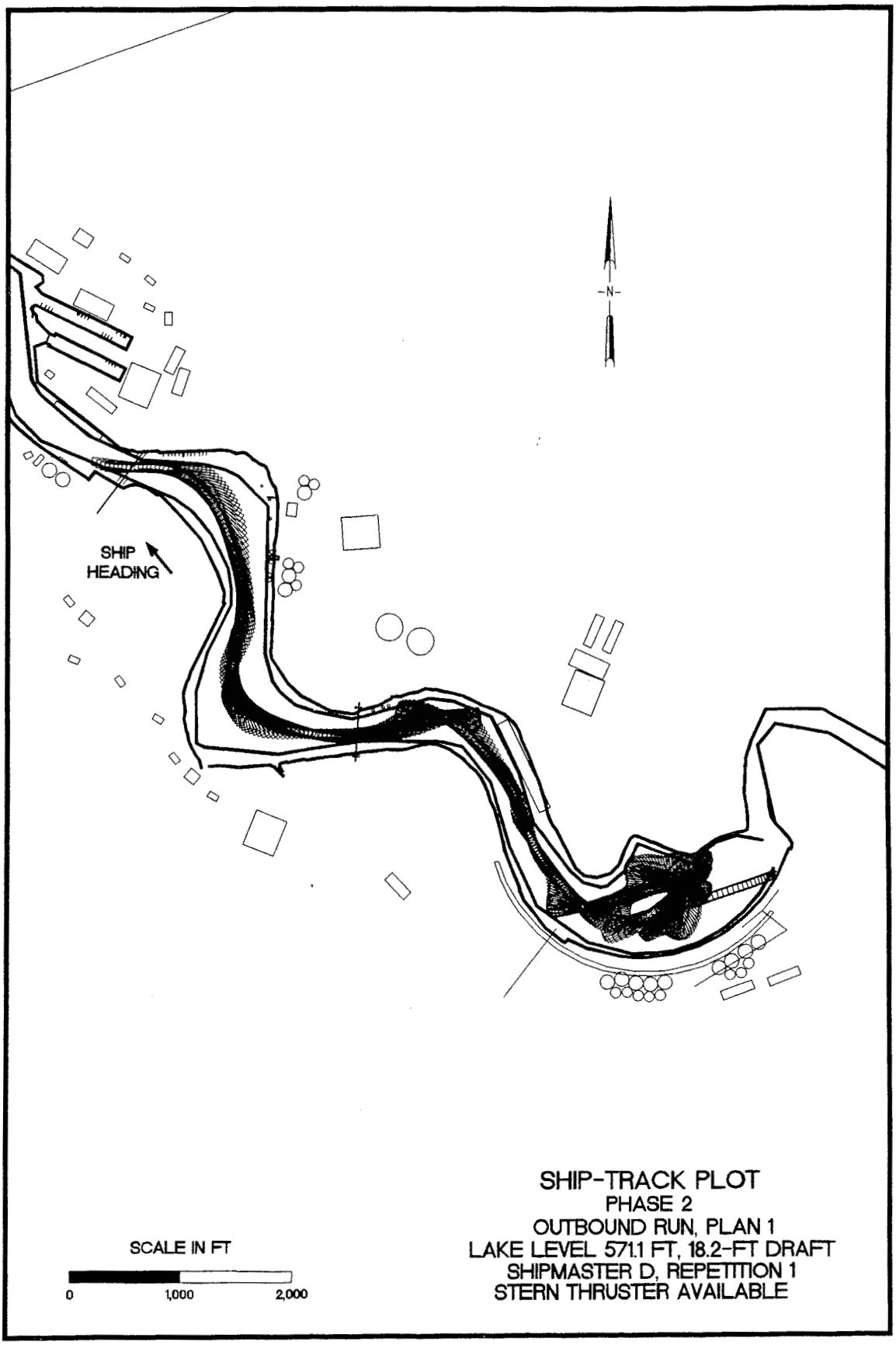
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 1
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER D, REPETITION 1
STERN THRUSTER NOT AVAILABLE



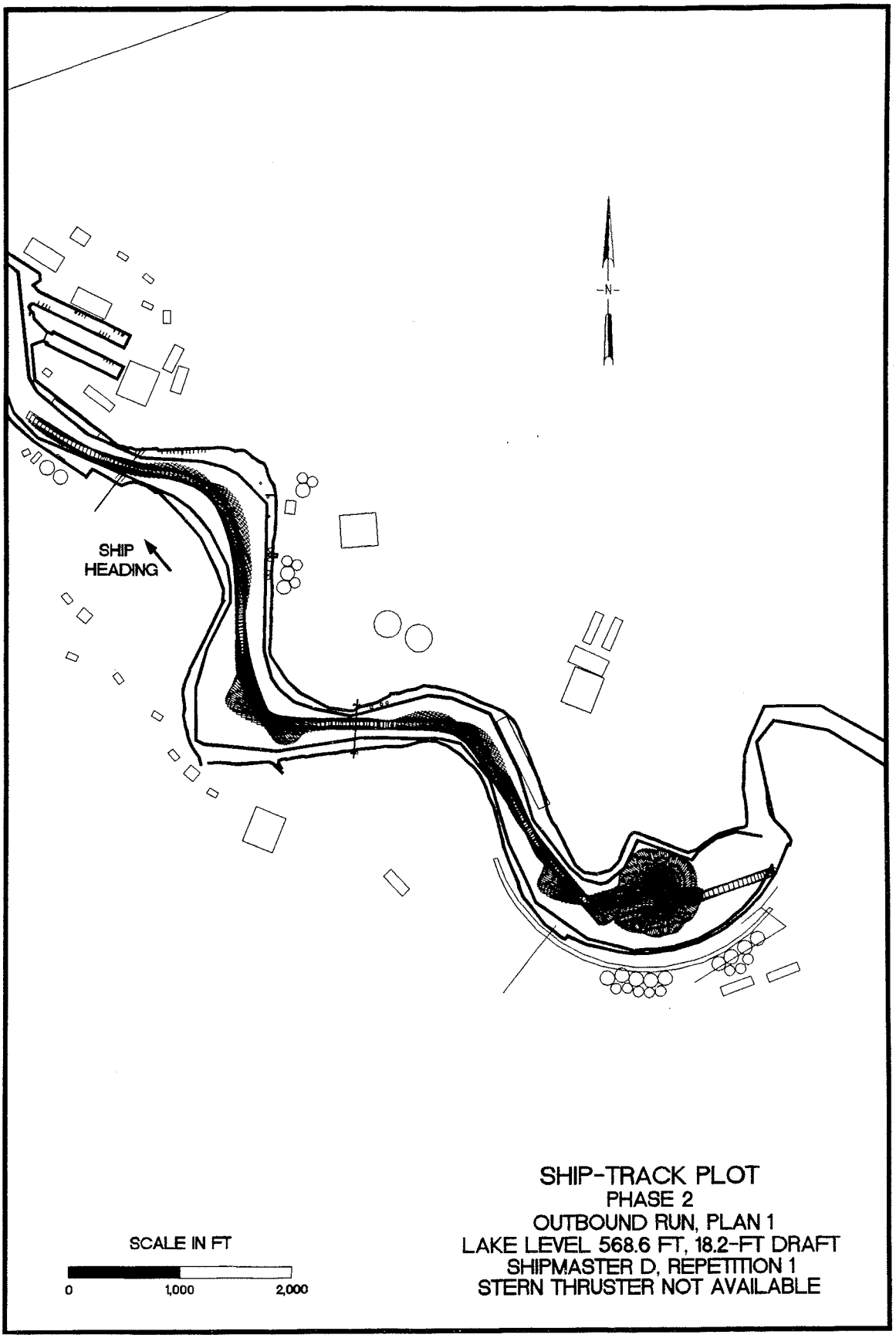
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 1
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER D, REPETITION 2
STERN THRUSTER NOT AVAILABLE



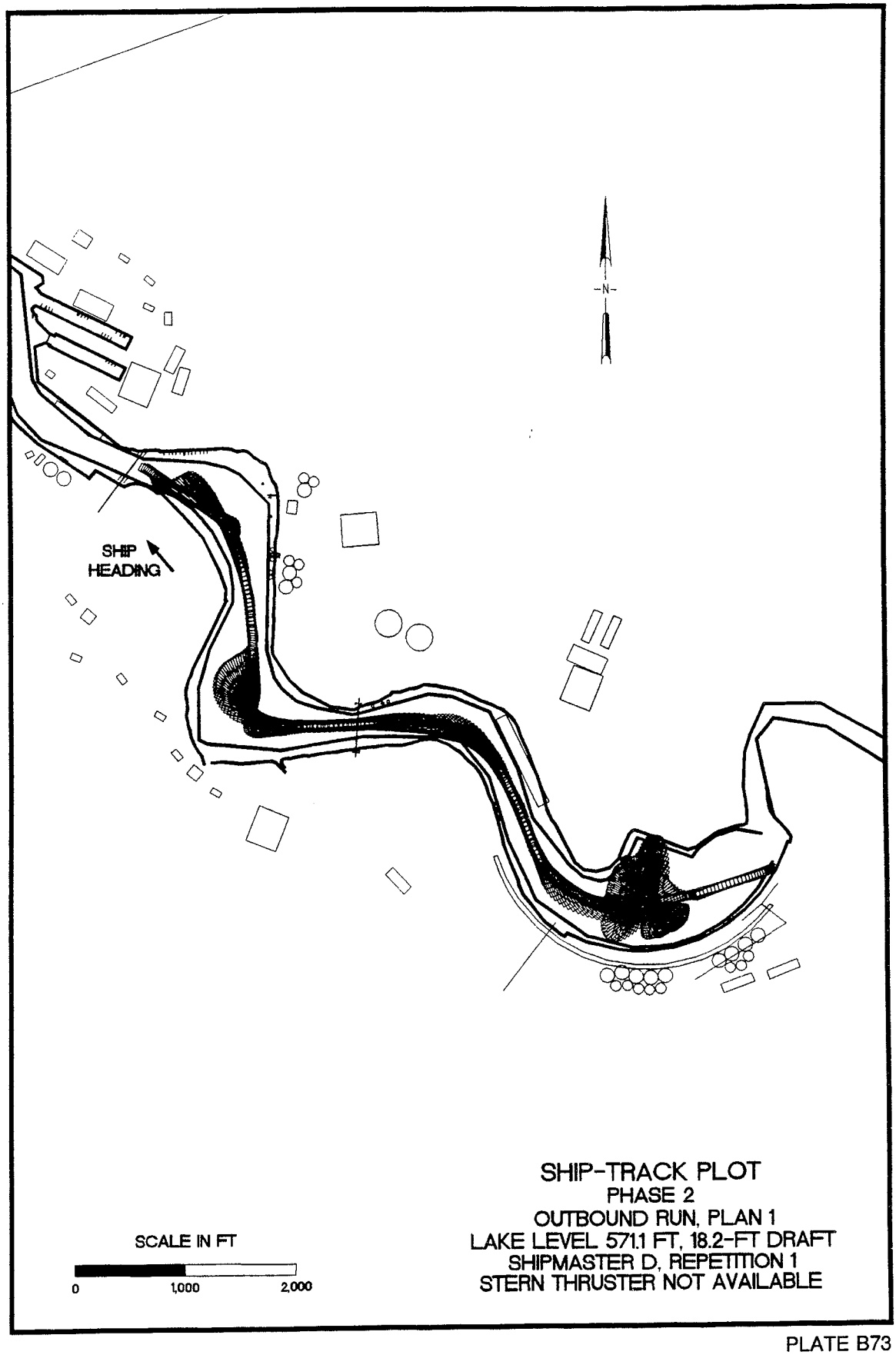
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 1
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER D, REPETITION 1
STERN THRUSTER AVAILABLE



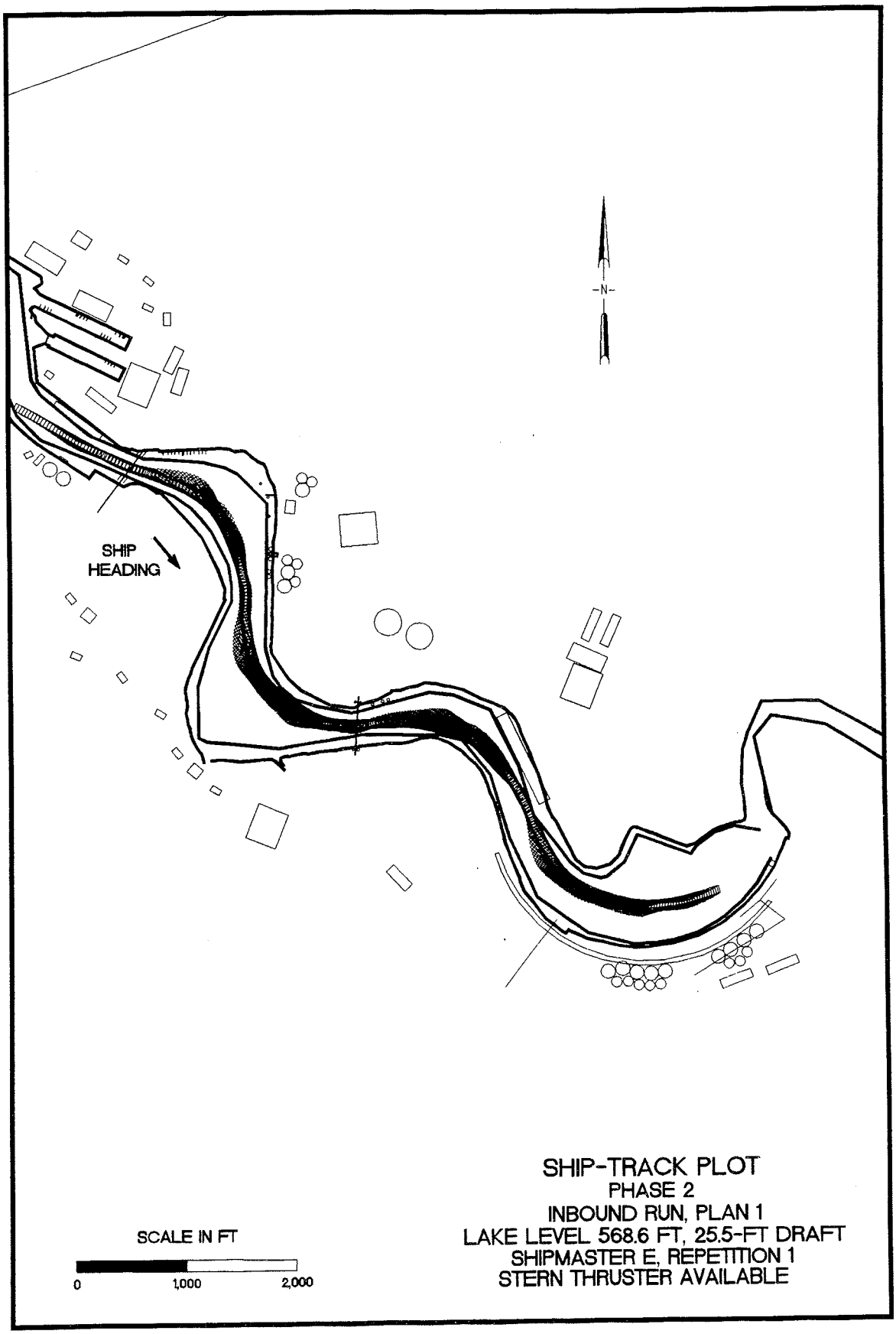
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 1
LAKE LEVEL 571.1 FT, 18.2-FT DRAFT
SHIPMASTER D, REPETITION 1
STERN THRUSTER AVAILABLE



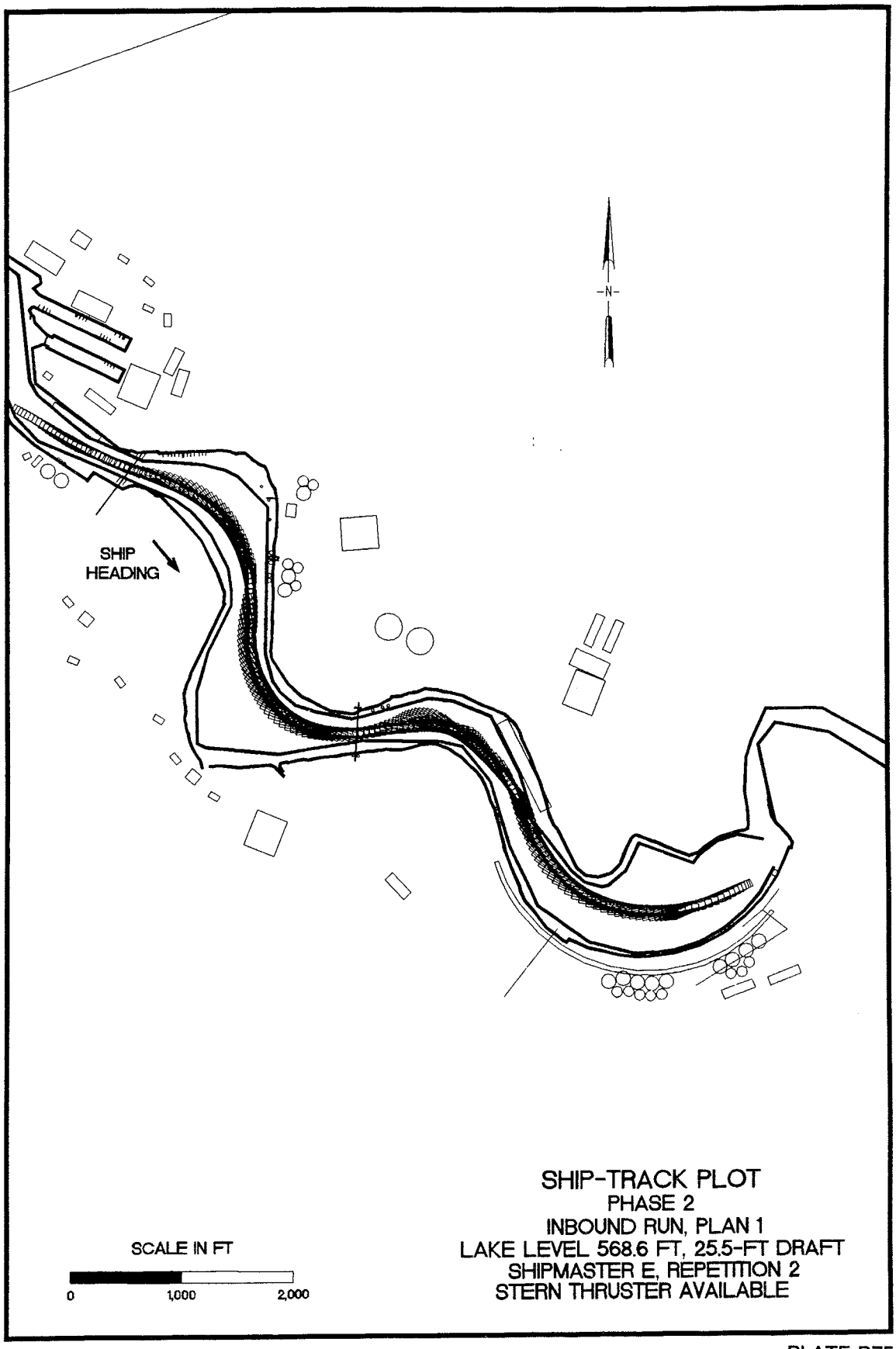
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 1
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER D, REPETITION 1
STERN THRUSTER NOT AVAILABLE



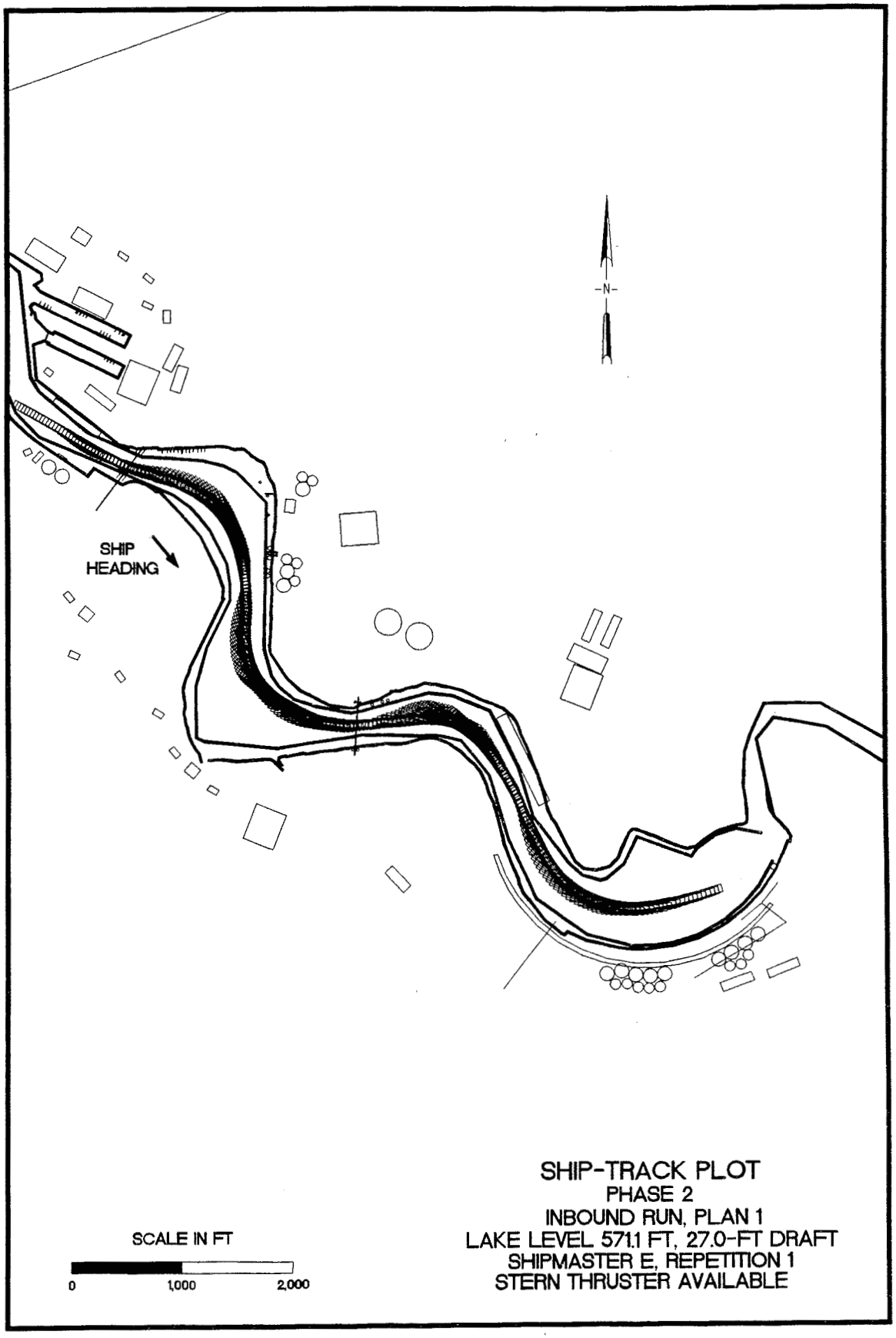
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 1
LAKE LEVEL 571.1 FT, 18.2-FT DRAFT
SHIPMASTER D, REPETITION 1
STERN THRUSTER NOT AVAILABLE

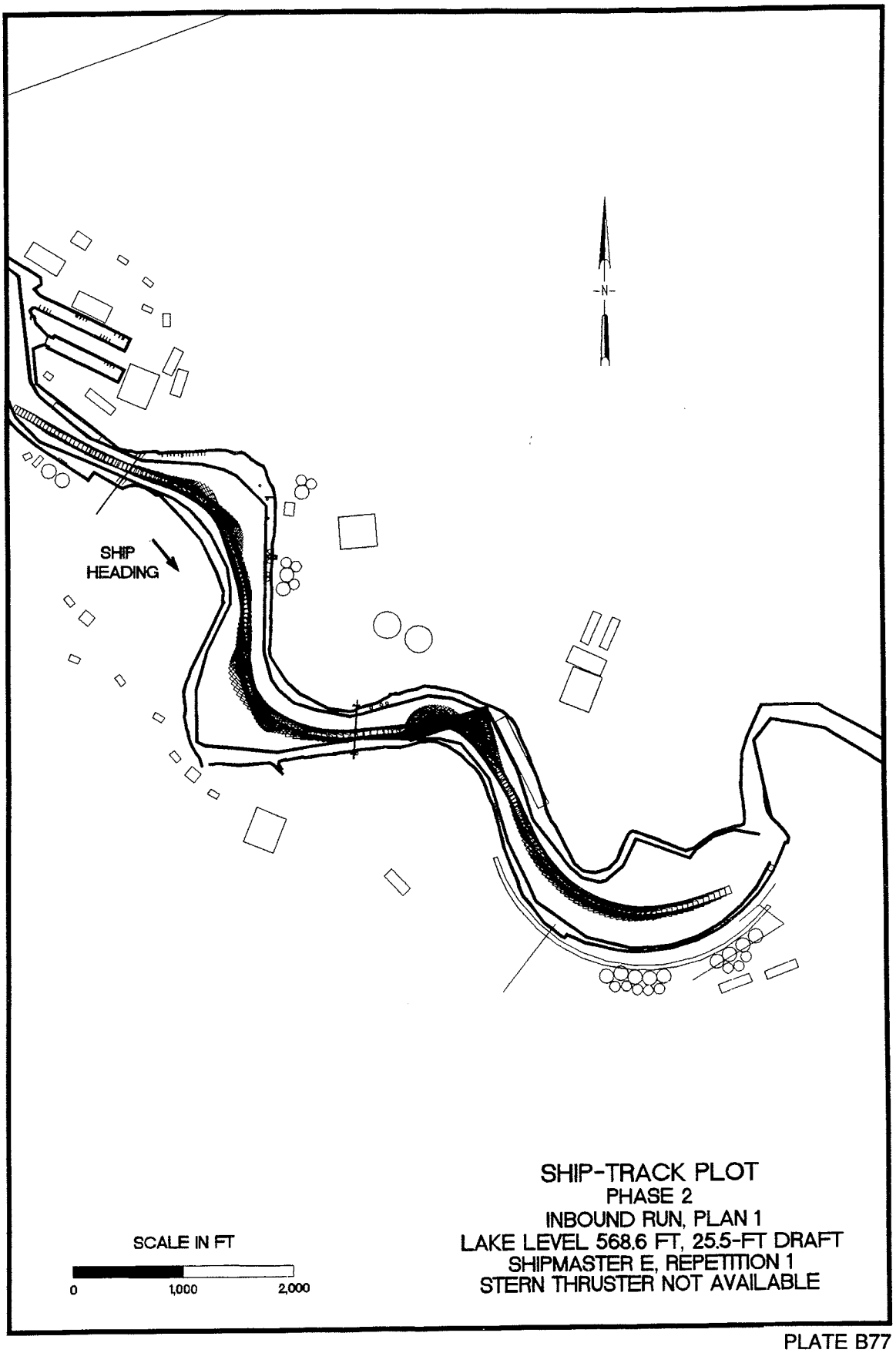


SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 1
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER E, REPETITION 1
STERN THRUSTER AVAILABLE

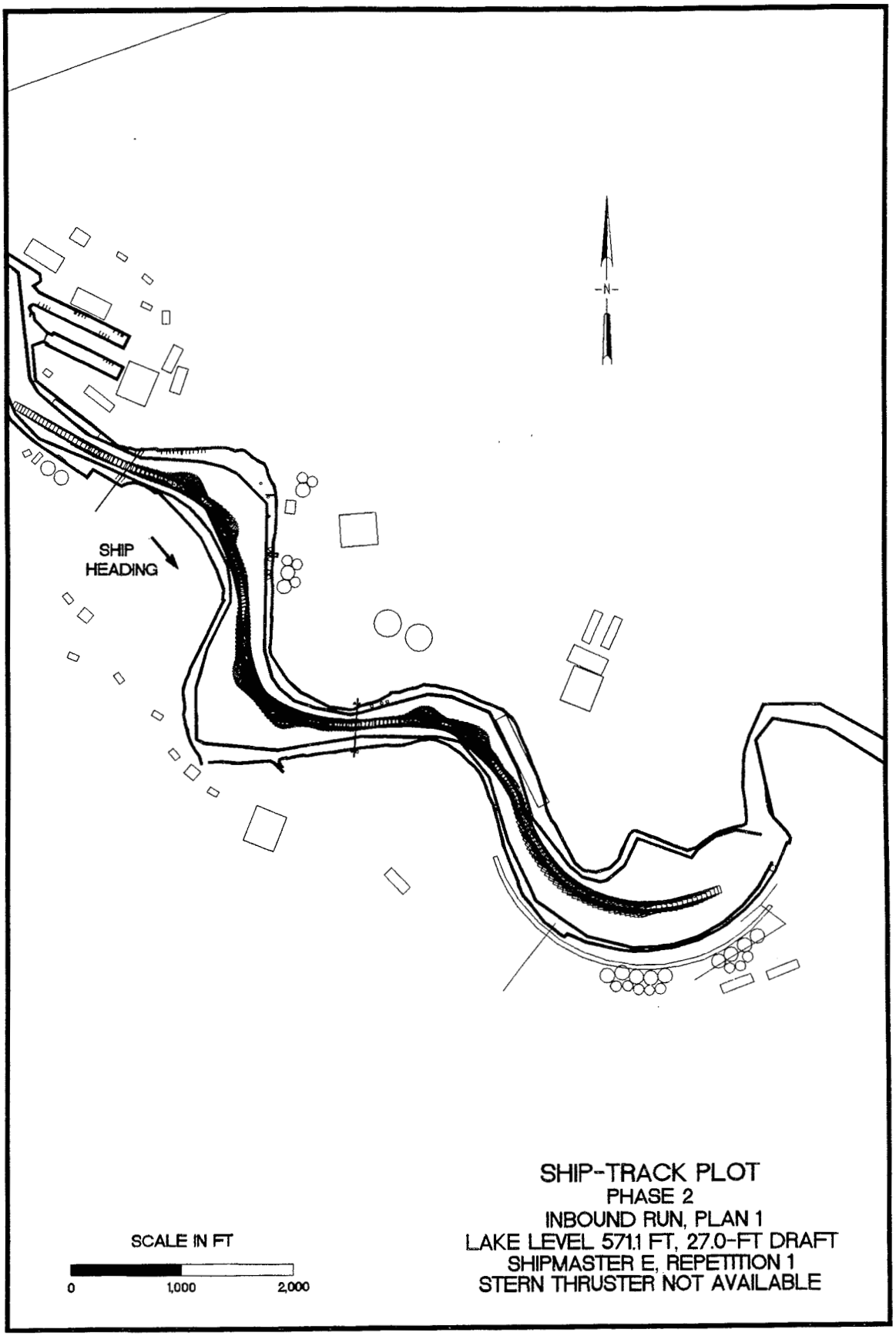


SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 1
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER E, REPETITION 2
STERN THRUSTER AVAILABLE

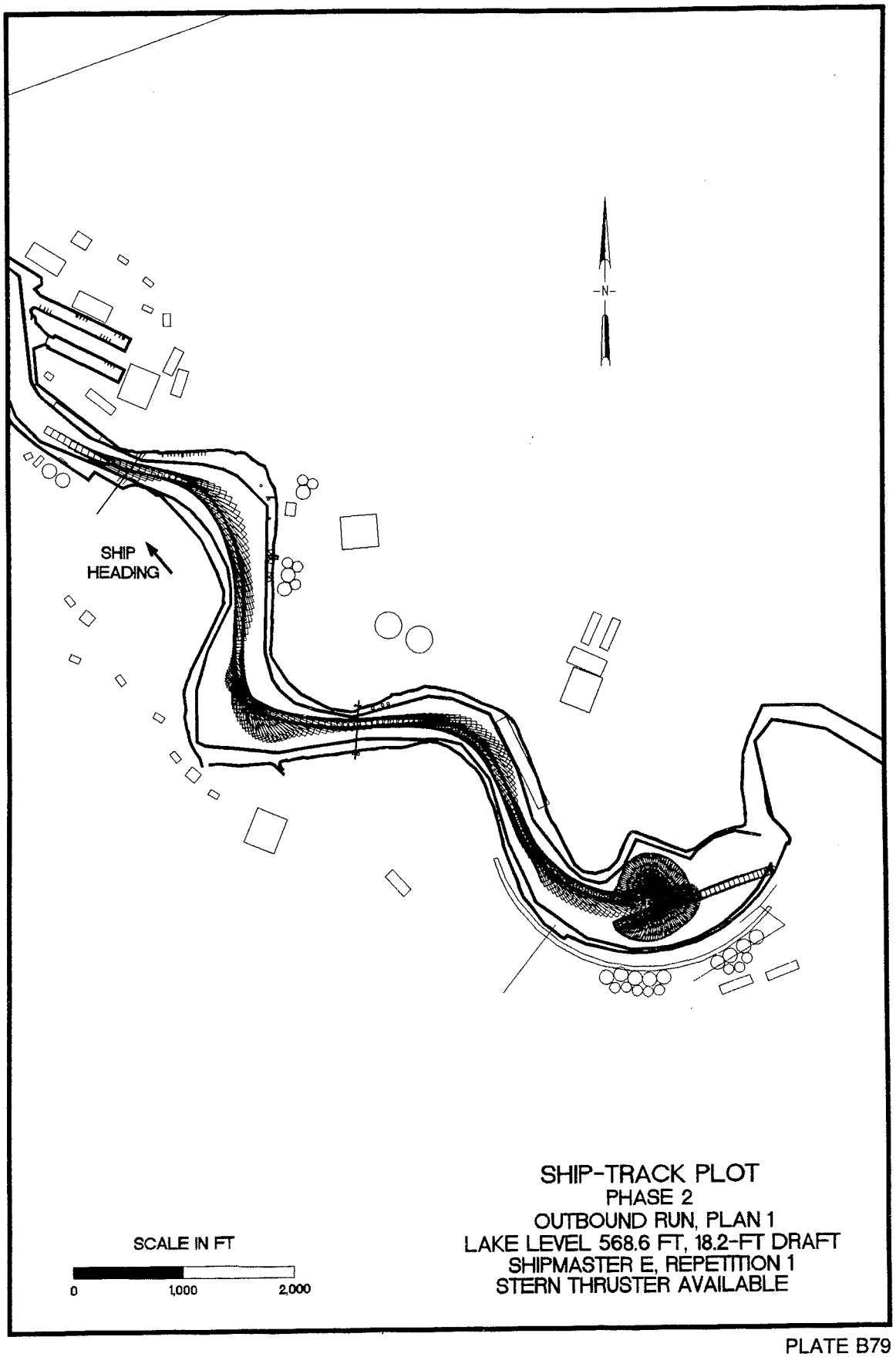

-N-
SHIP
HEADING
SCALE IN FT
0
1,000
2,000
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 1
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER E, REPETITION 1
STERN THRUSTER AVAILABLE



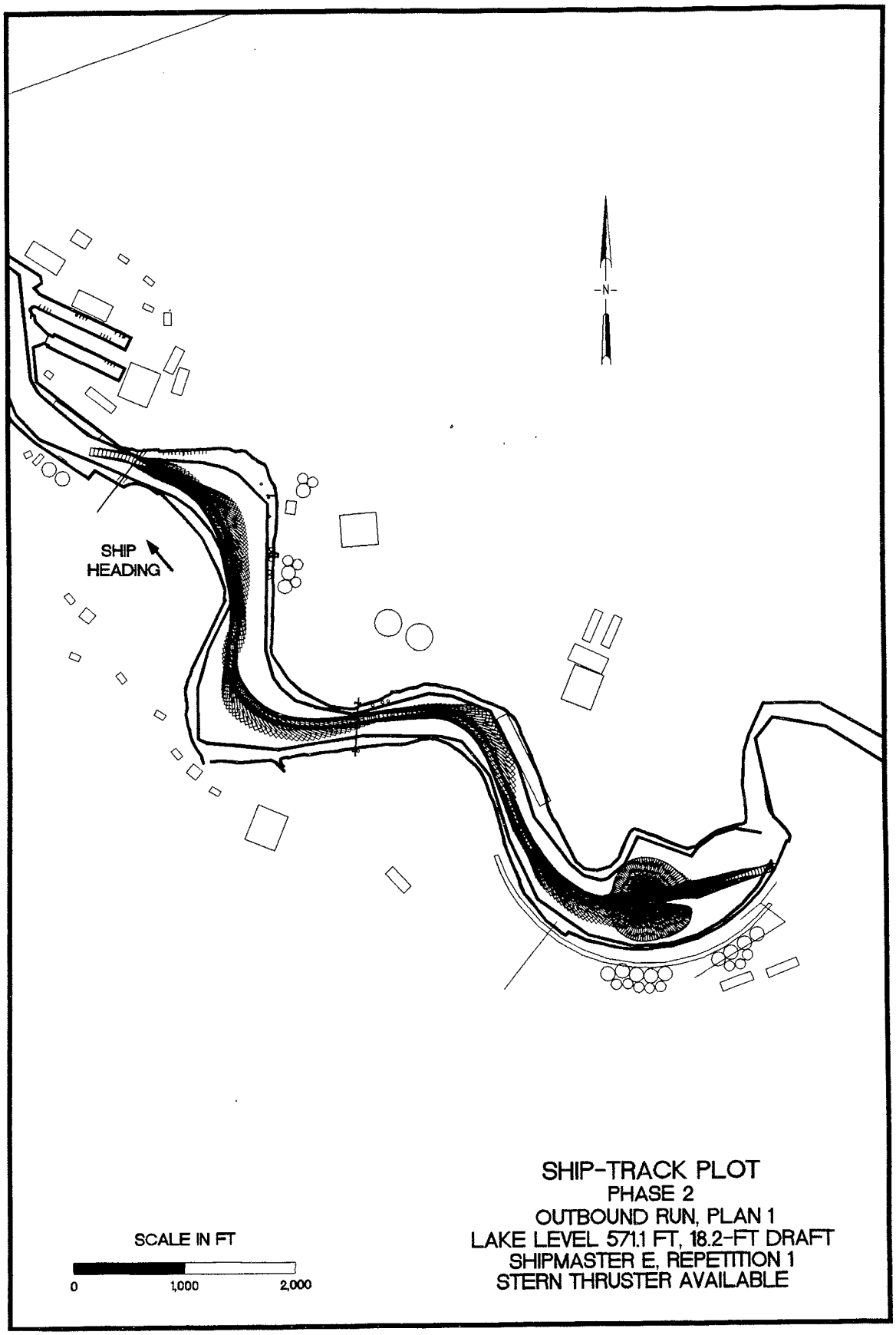
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 1
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER E, REPETITION 1
STERN THRUSTER NOT AVAILABLE



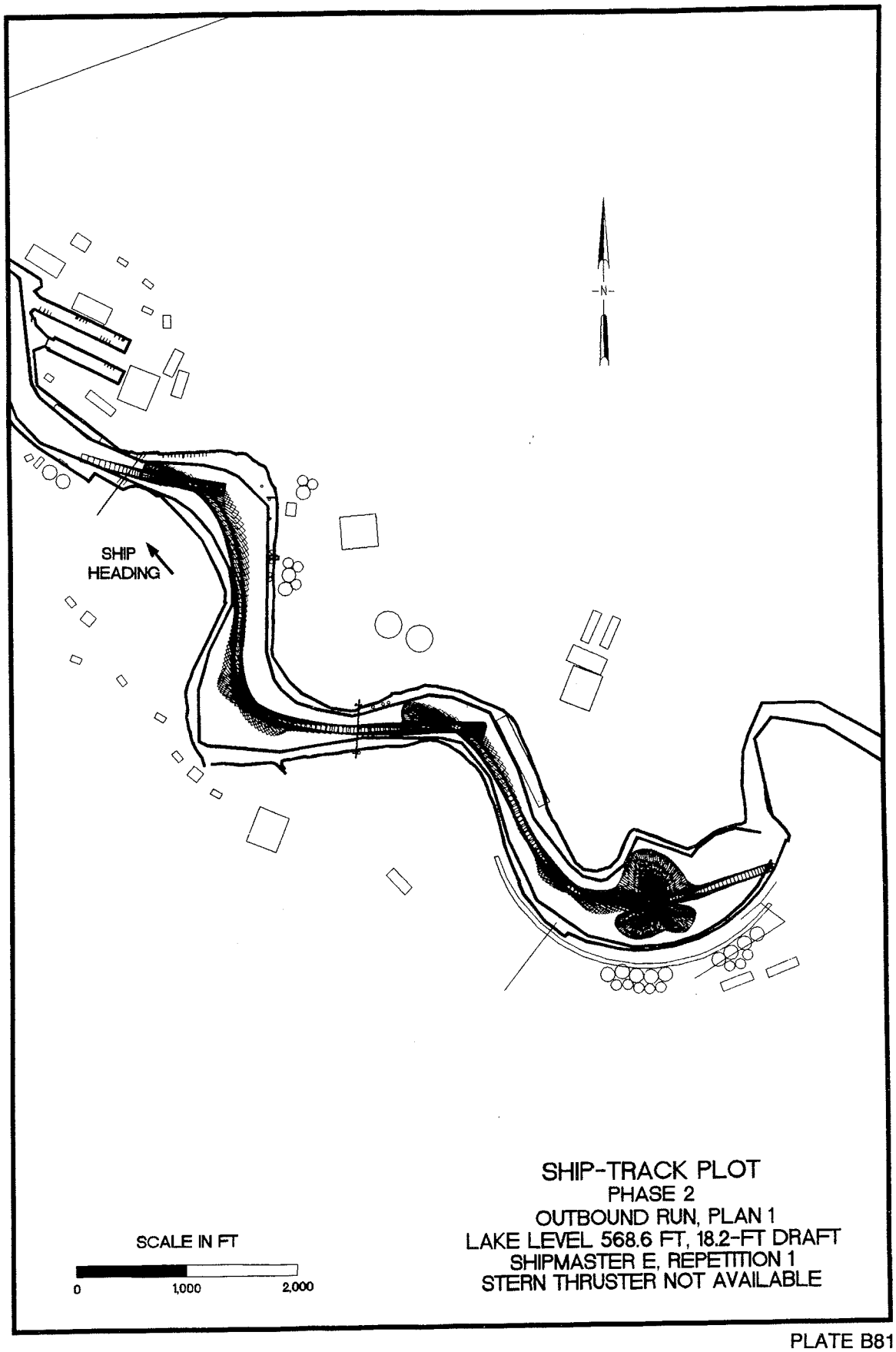
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 1
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER E, REPETITION 1
STERN THRUSTER NOT AVAILABLE



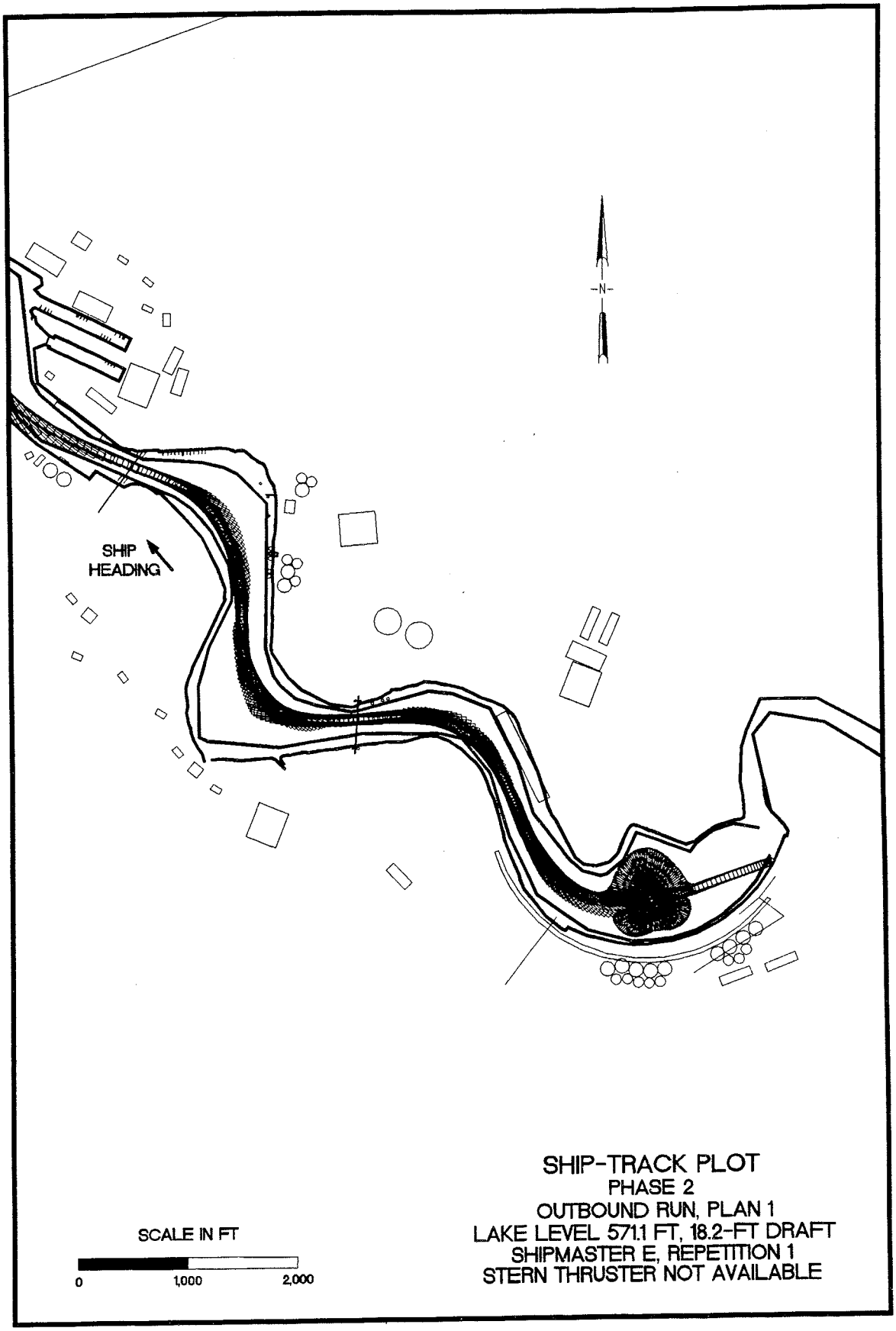
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 1
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER E, REPETITION 1
STERN THRUSTER AVAILABLE



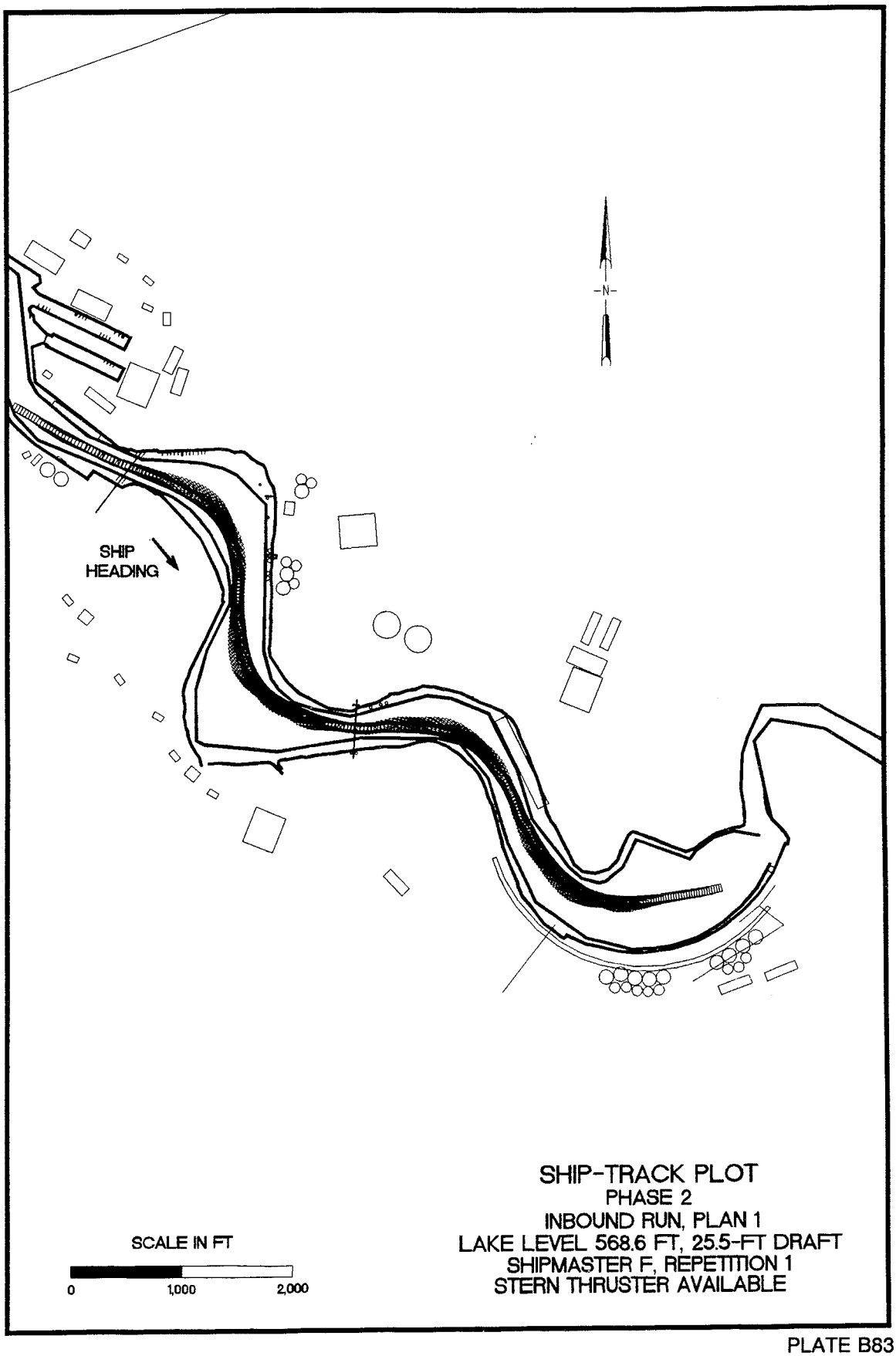
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 1
LAKE LEVEL 571.1 FT, 18.2-FT DRAFT
SHIPMASTER E, REPETITION 1
STERN THRUSTER AVAILABLE



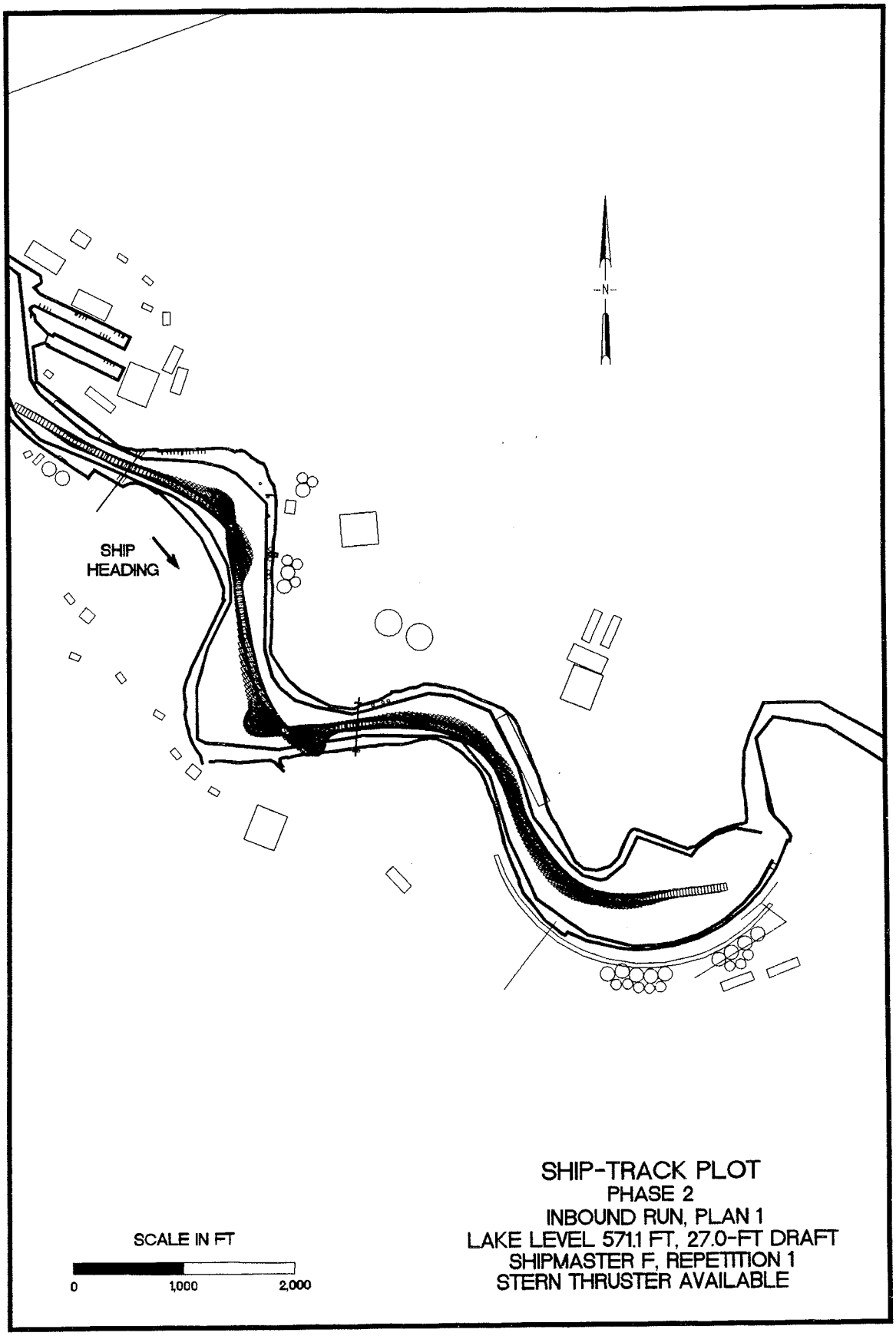
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 1
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER E, REPETITION 1
STERN THRUSTER NOT AVAILABLE



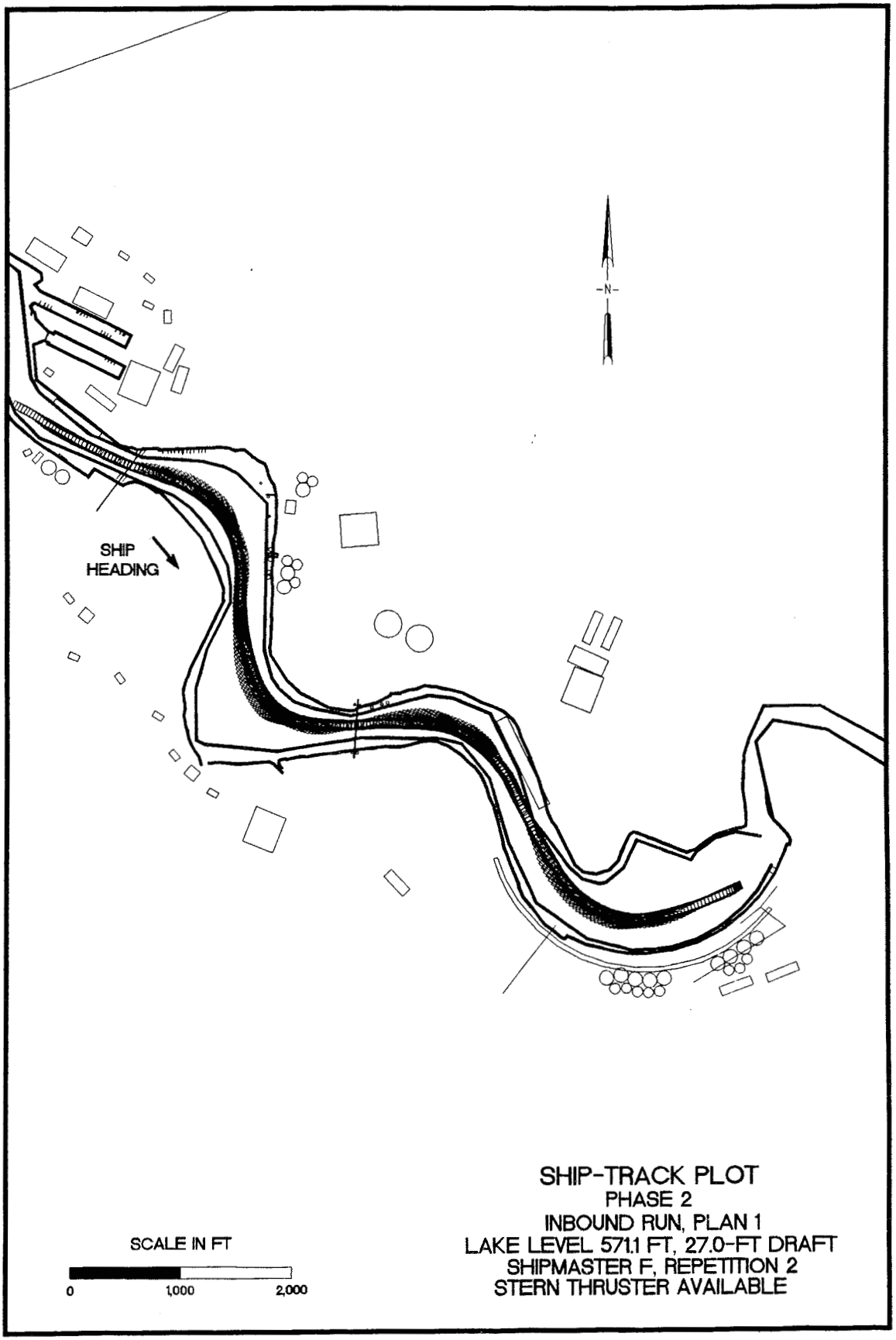
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 1
LAKE LEVEL 571.1 FT, 18.2-FT DRAFT
SHIPMASTER E, REPETITION 1
STERN THRUSTER NOT AVAILABLE



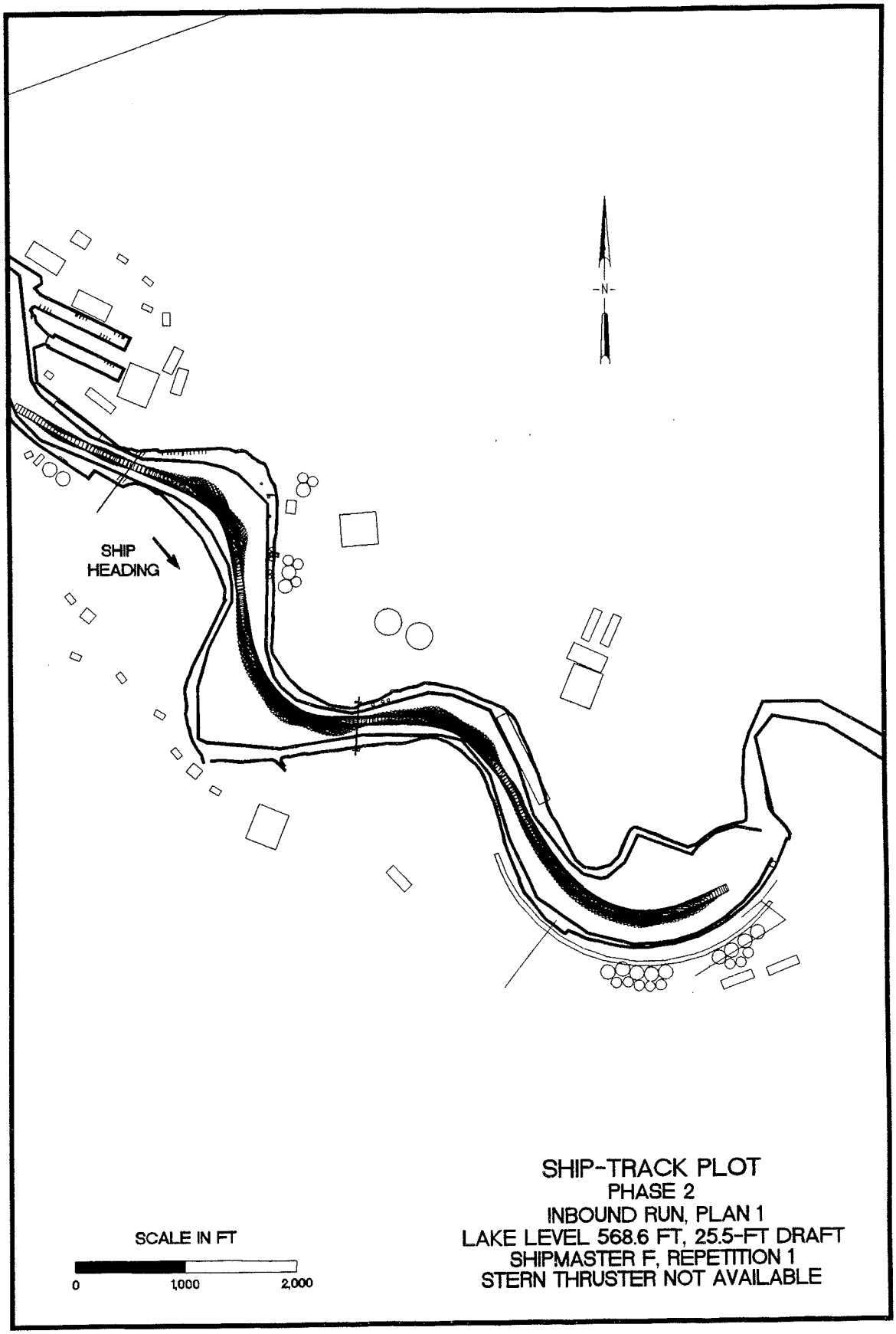
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 1
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER F, REPETITION 1
STERN THRUSTER AVAILABLE



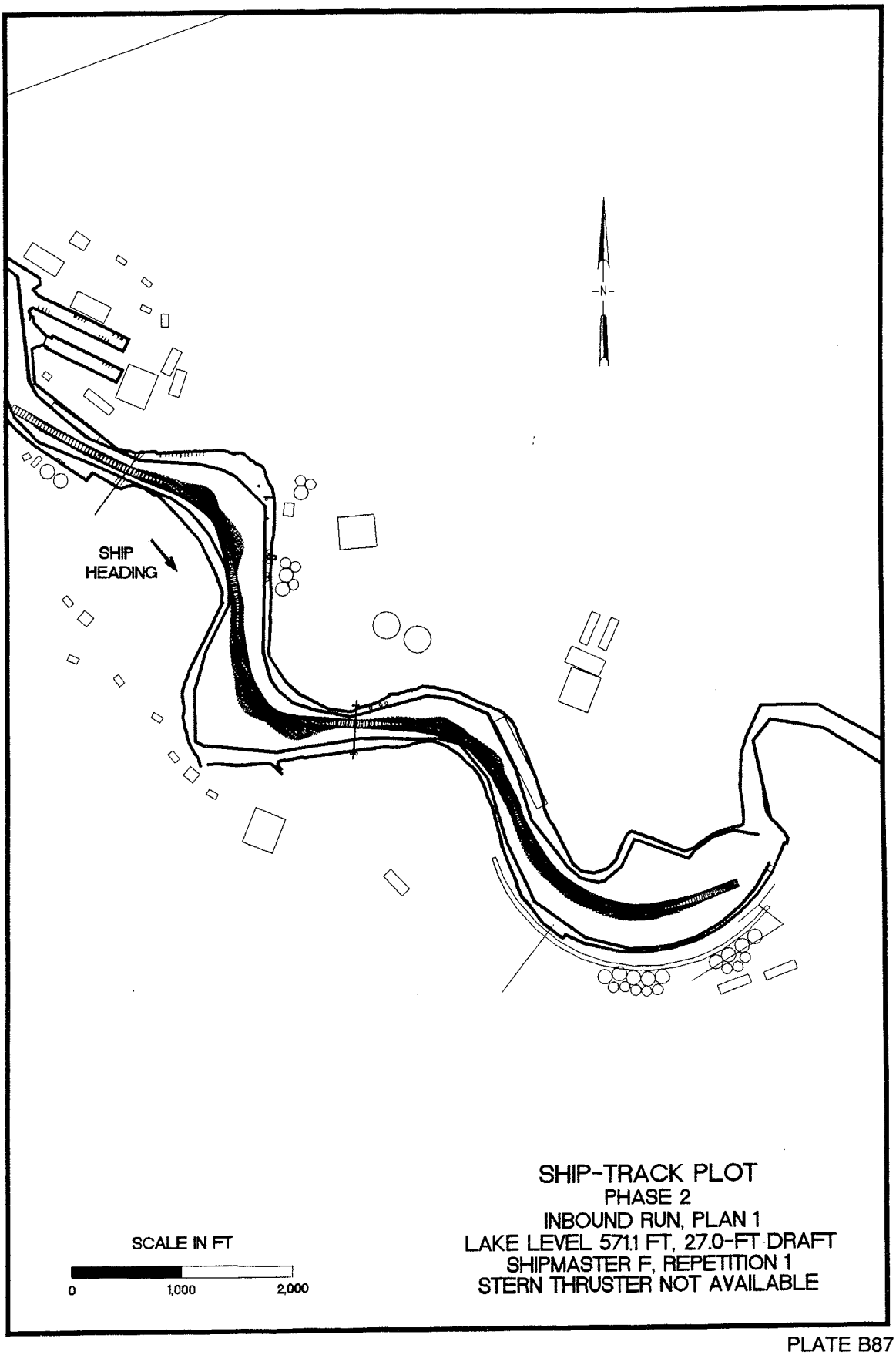
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 1
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER F, REPETITION 1
STERN THRUSTER AVAILABLE



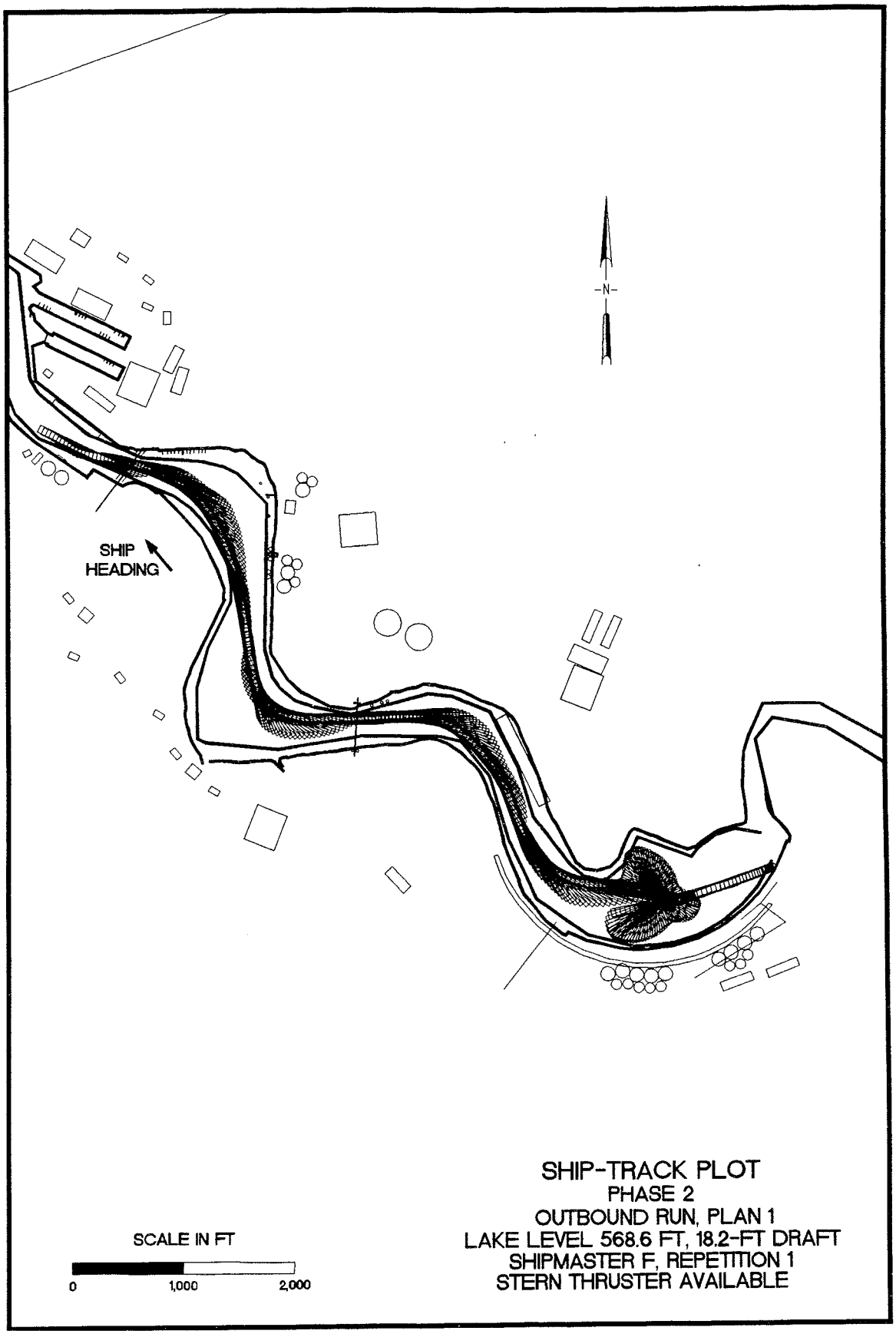
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 1
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER F, REPETITION 2
STERN THRUSTER AVAILABLE



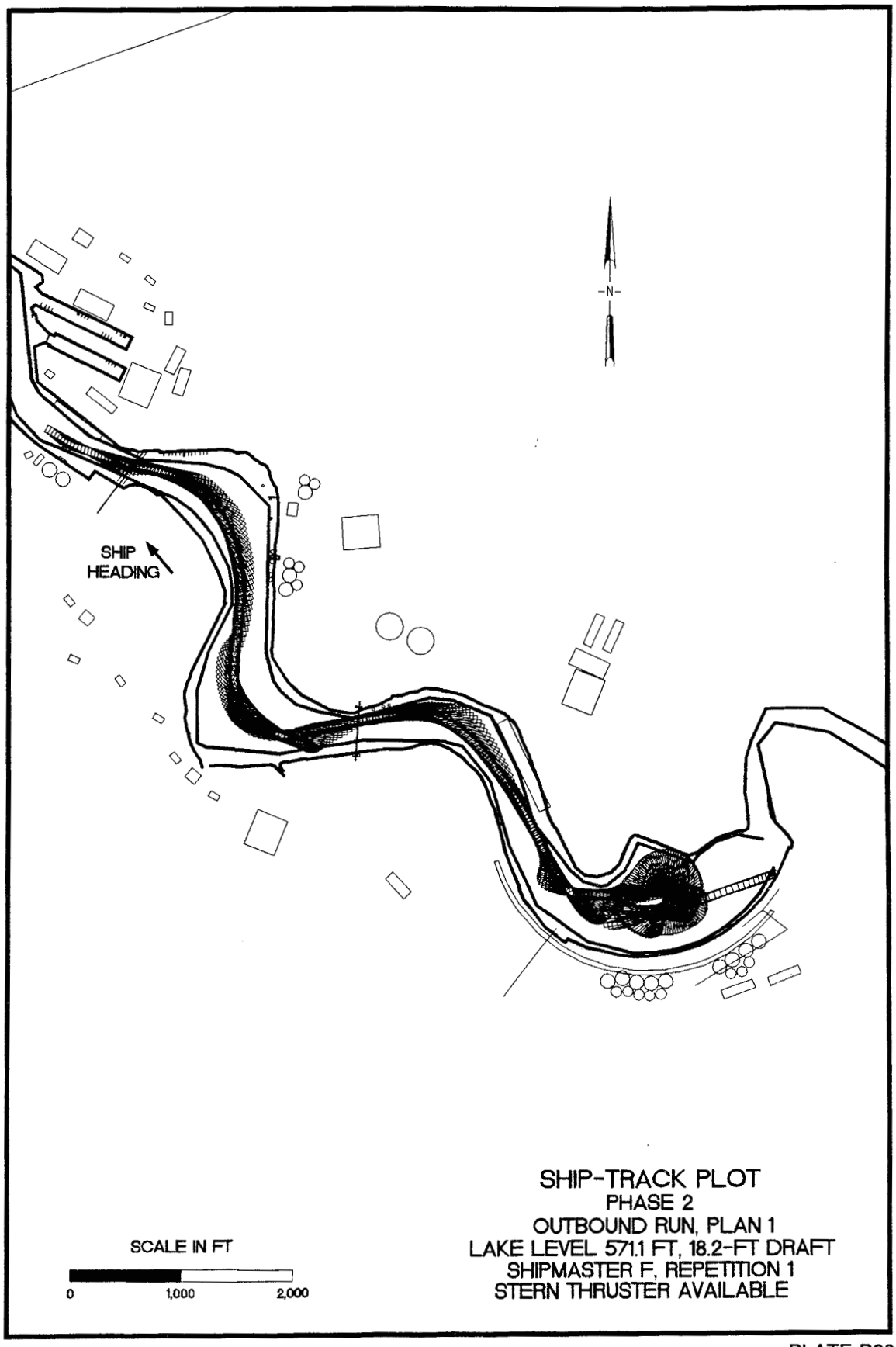
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 1
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER F, REPETITION 1
STERN THRUSTER NOT AVAILABLE



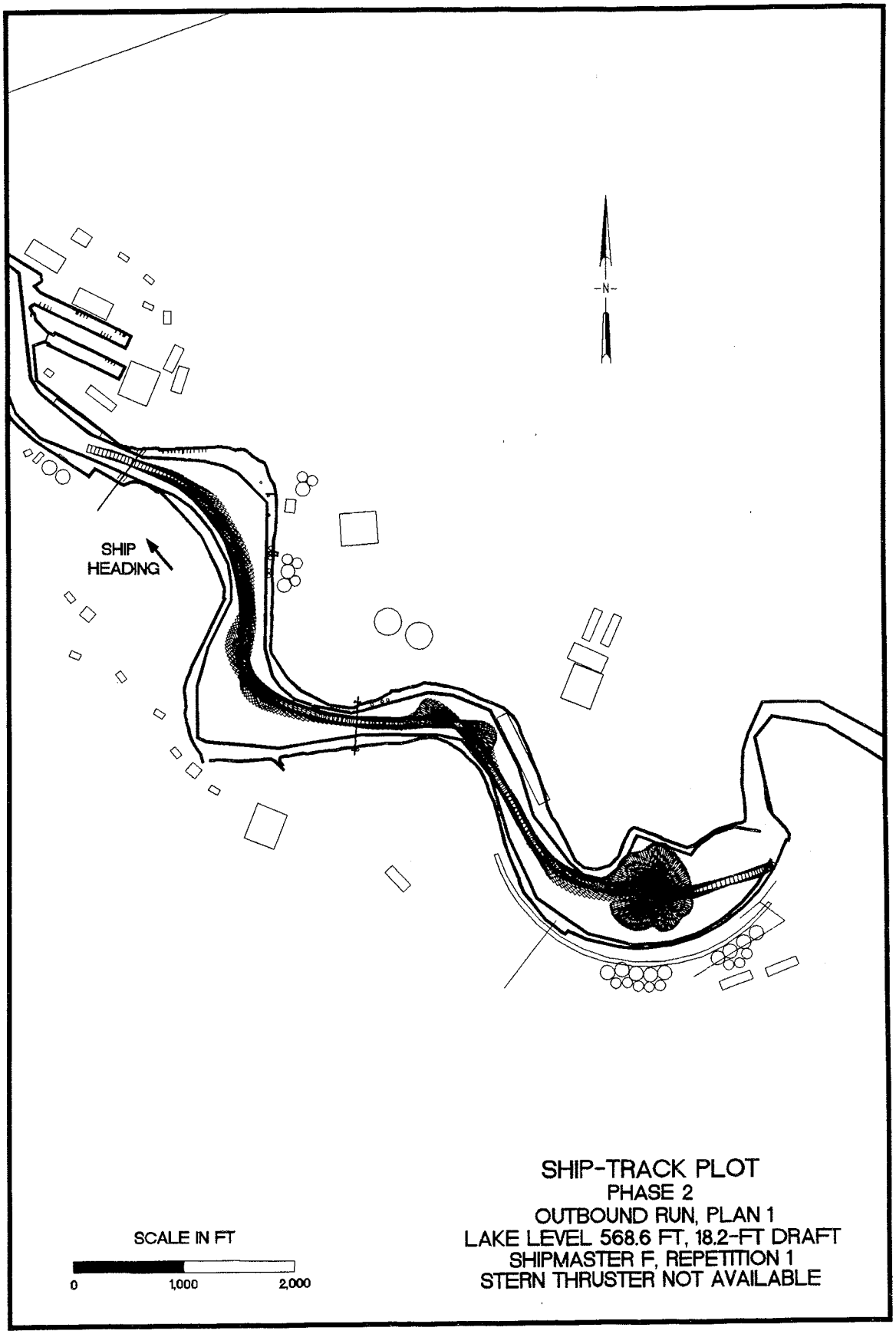
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 1
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER F, REPETITION 1
STERN THRUSTER NOT AVAILABLE



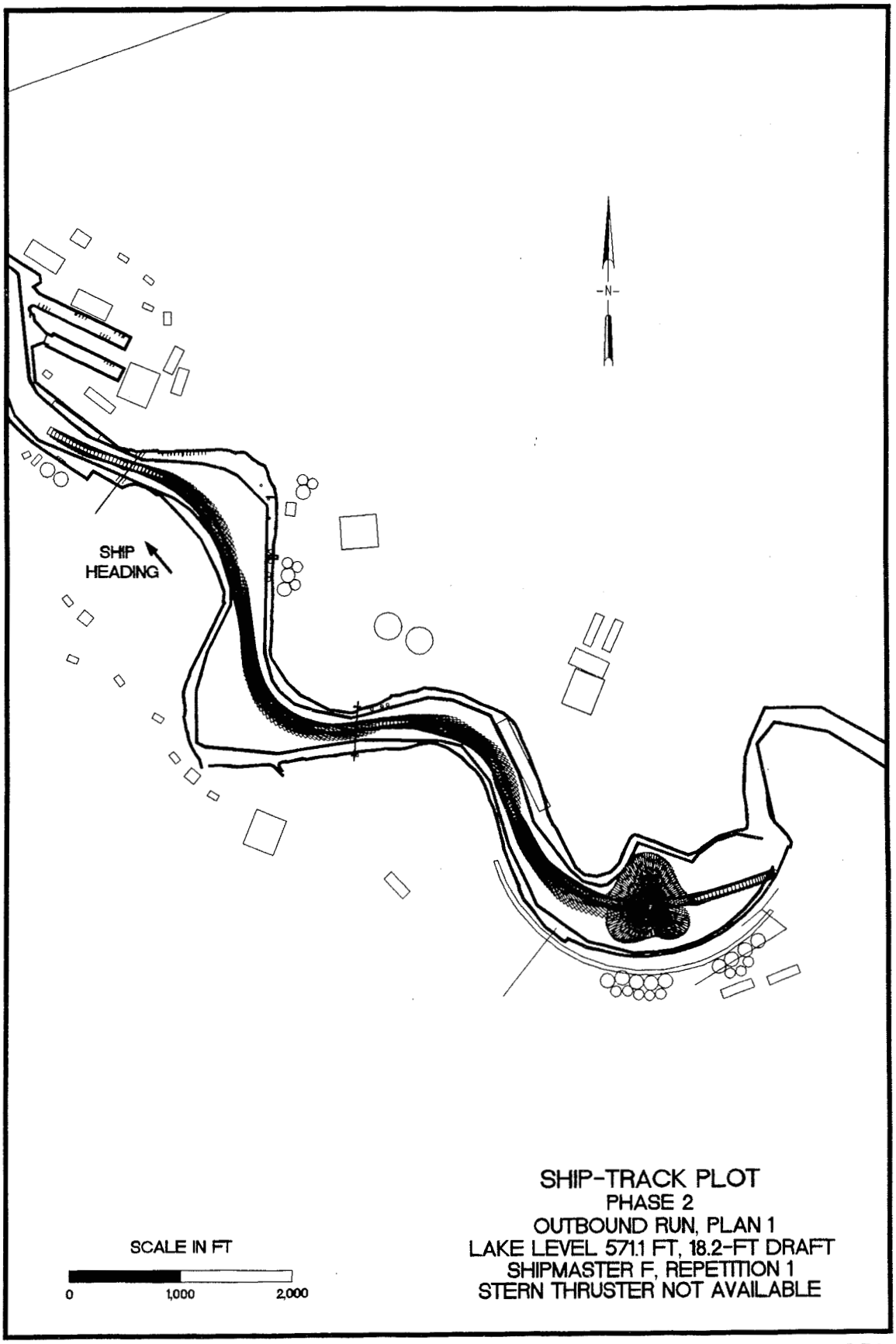
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 1
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER F, REPETITION 1
STERN THRUSTER AVAILABLE



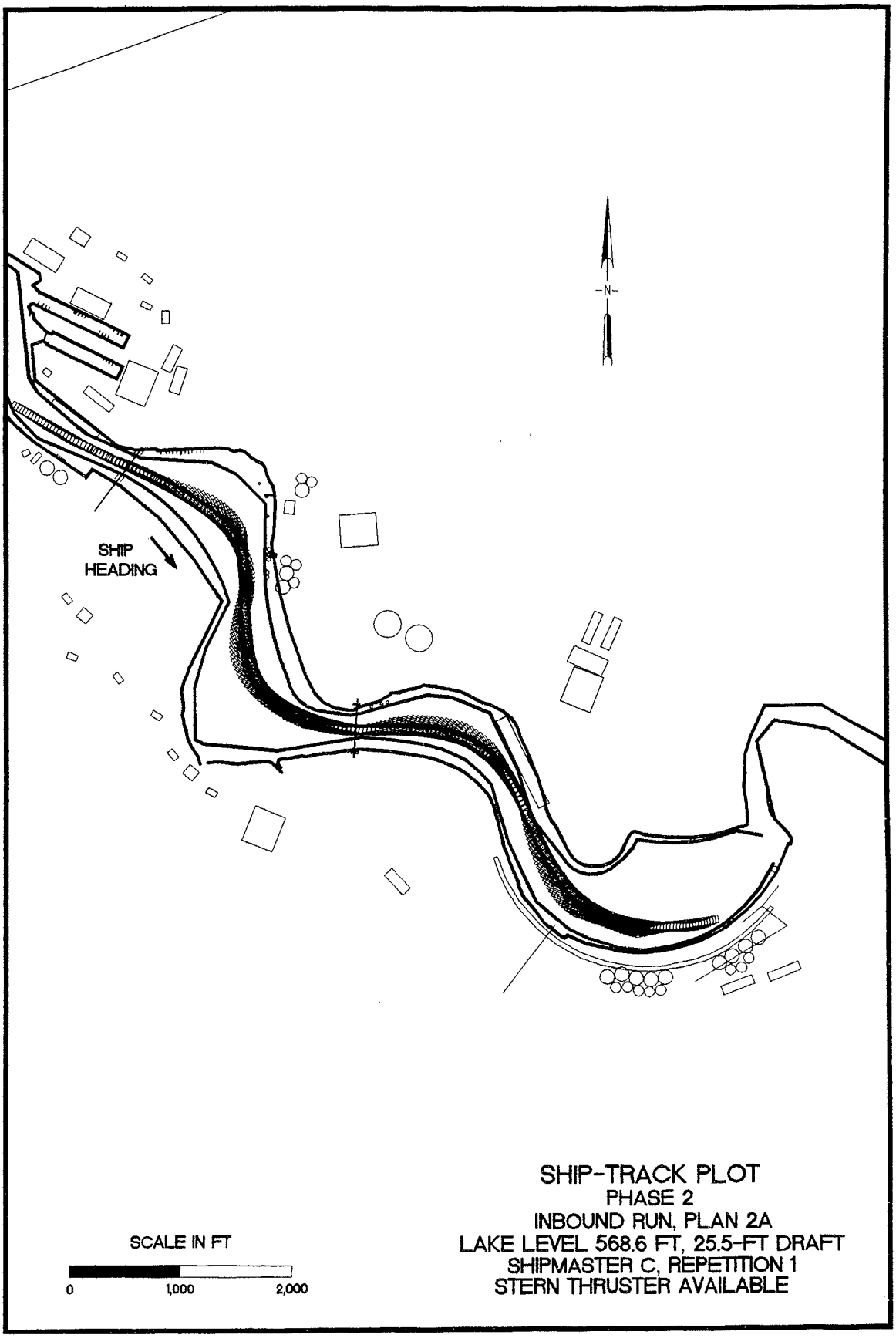
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 1
LAKE LEVEL 571.1 FT, 18.2-FT DRAFT
SHIPMASTER F, REPETITION 1
STERN THRUSTER AVAILABLE



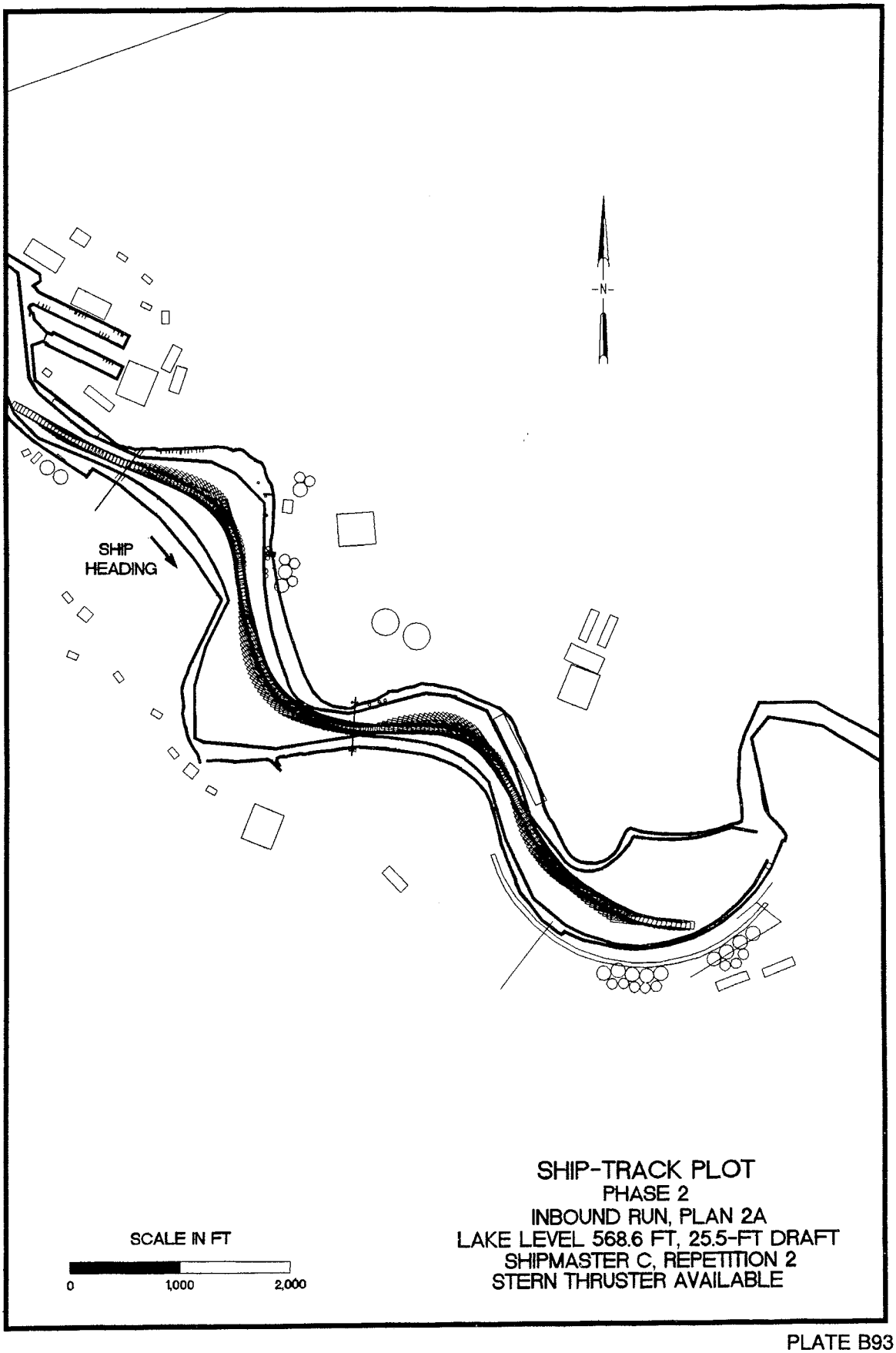
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 1
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER F, REPETITION 1
STERN THRUSTER NOT AVAILABLE



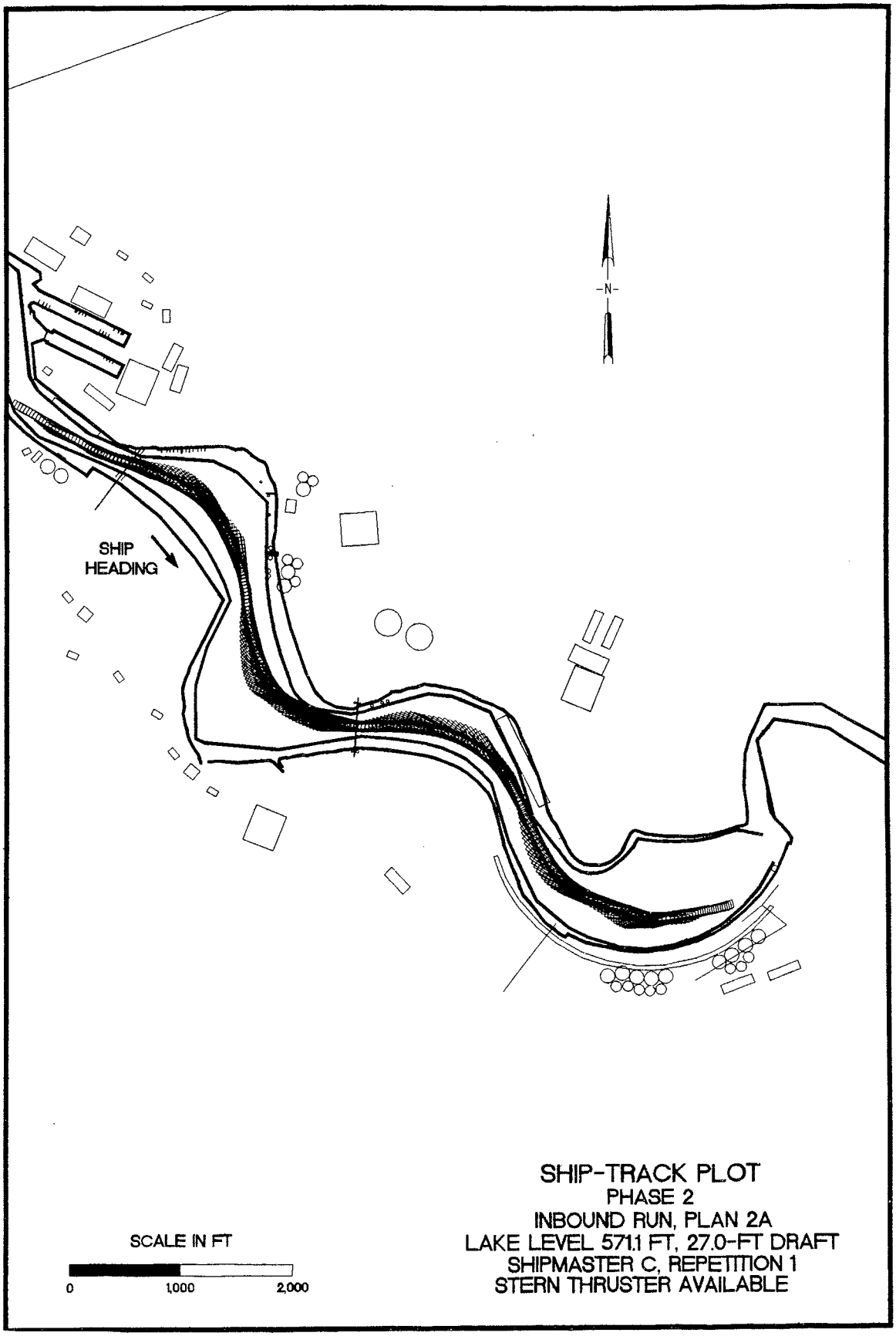
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 1
LAKE LEVEL 571.1 FT, 18.2-FT DRAFT
SHIPMASTER F, REPETITION 1
STERN THRUSTER NOT AVAILABLE



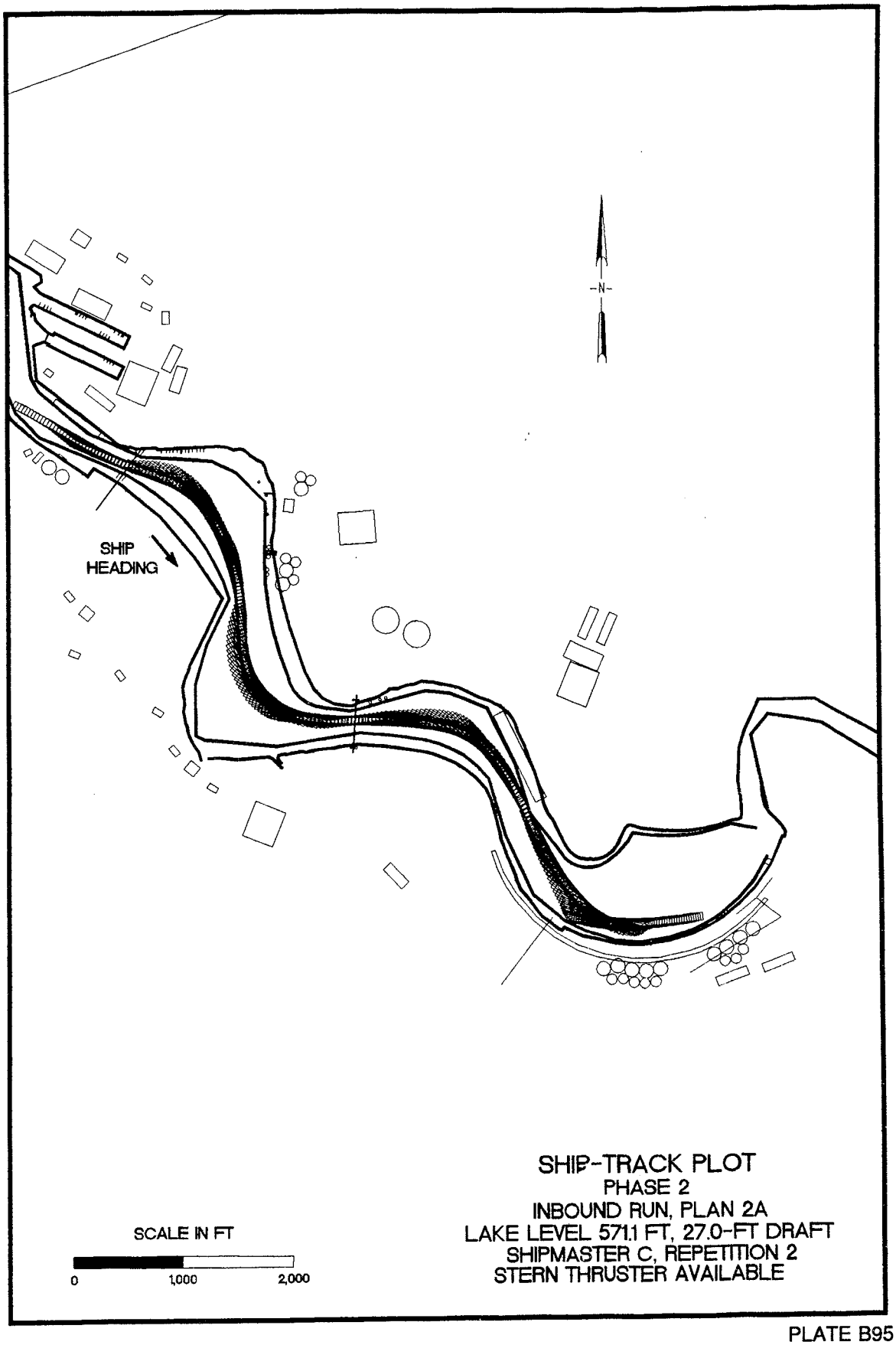
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 2A
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER C, REPETITION 1
STERN THRUSTER AVAILABLE



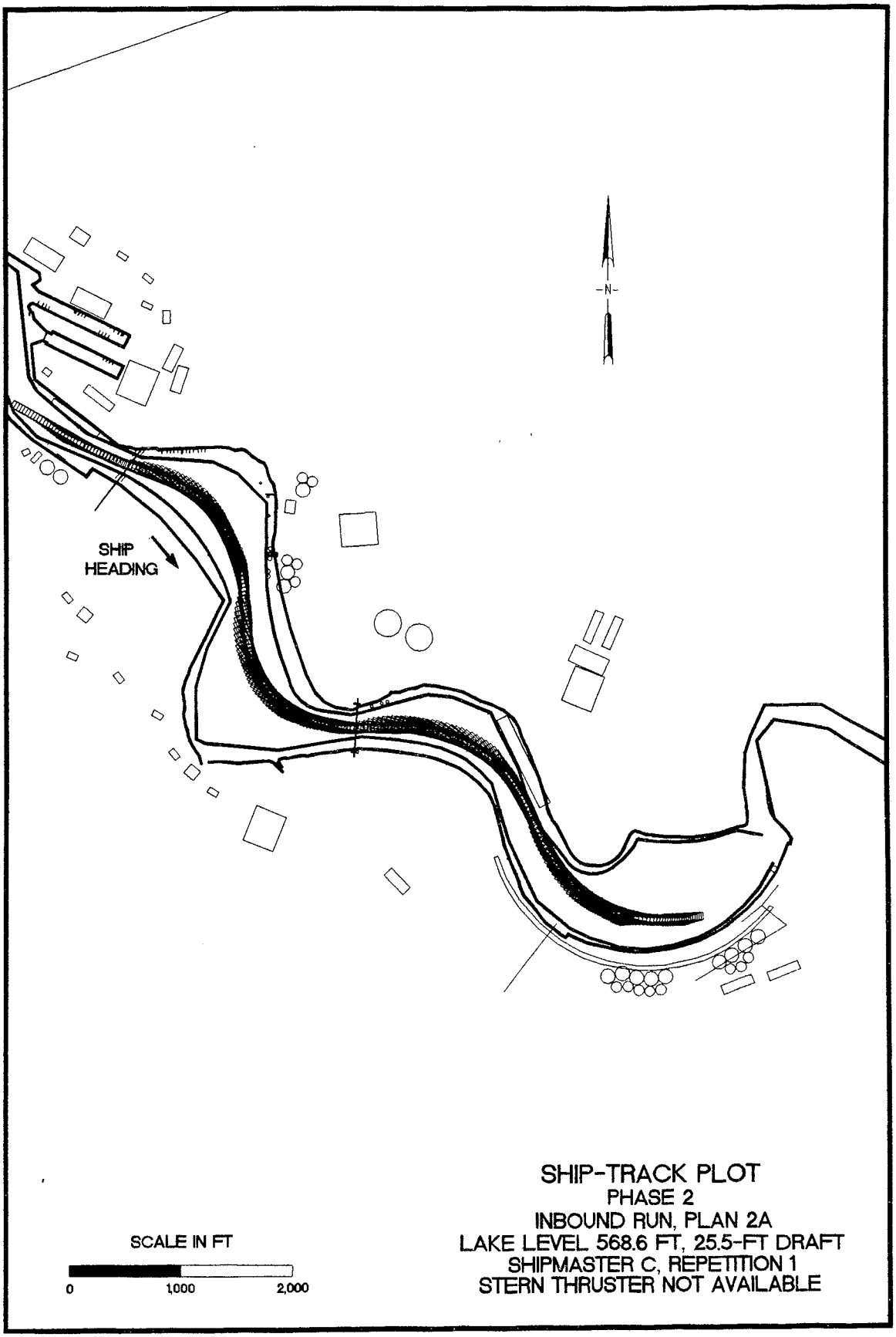
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 2A
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER C, REPETITION 2
STERN THRUSTER AVAILABLE



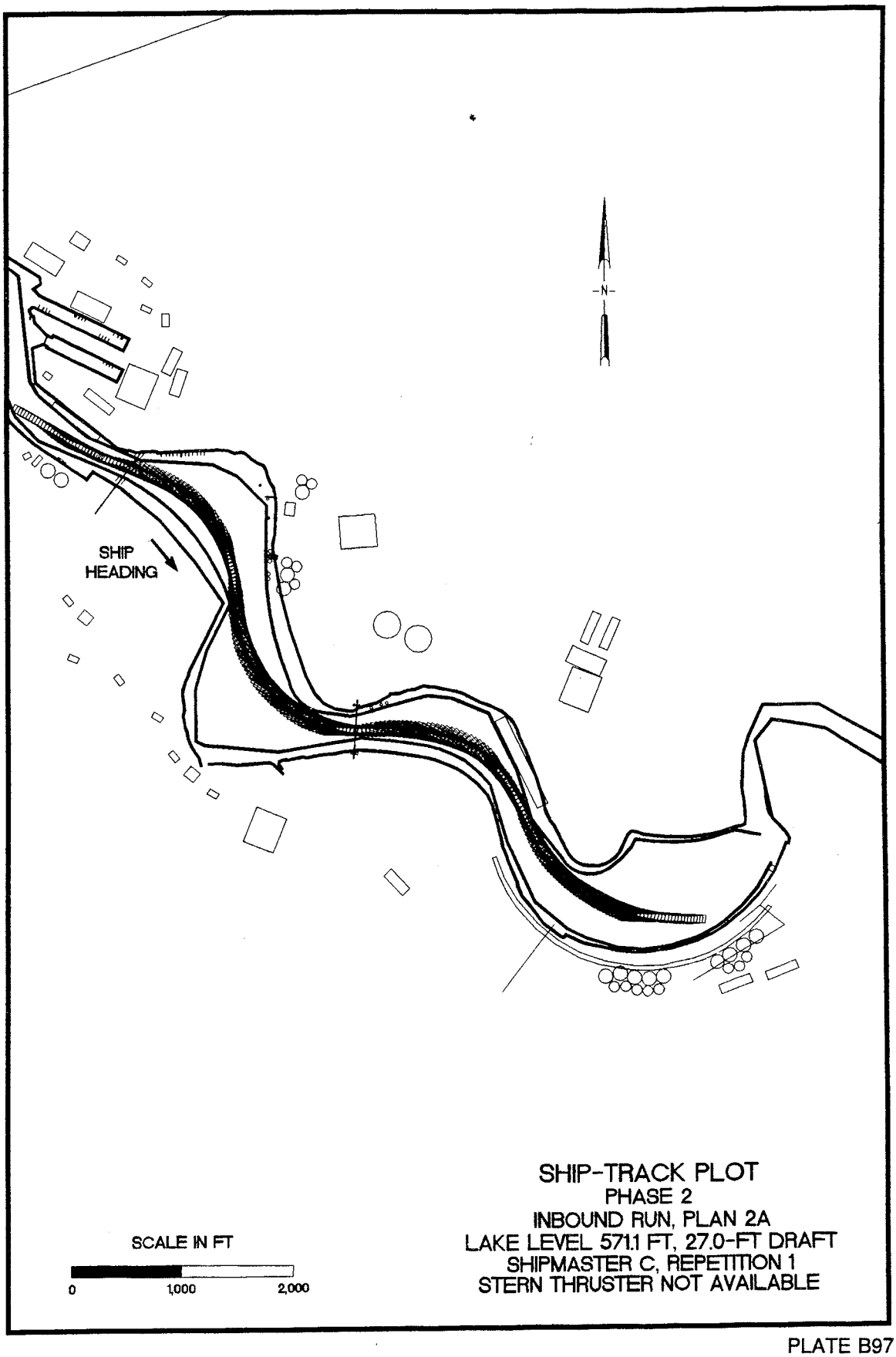
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 2A
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER C, REPETITION 1
STERN THRUSTER AVAILABLE



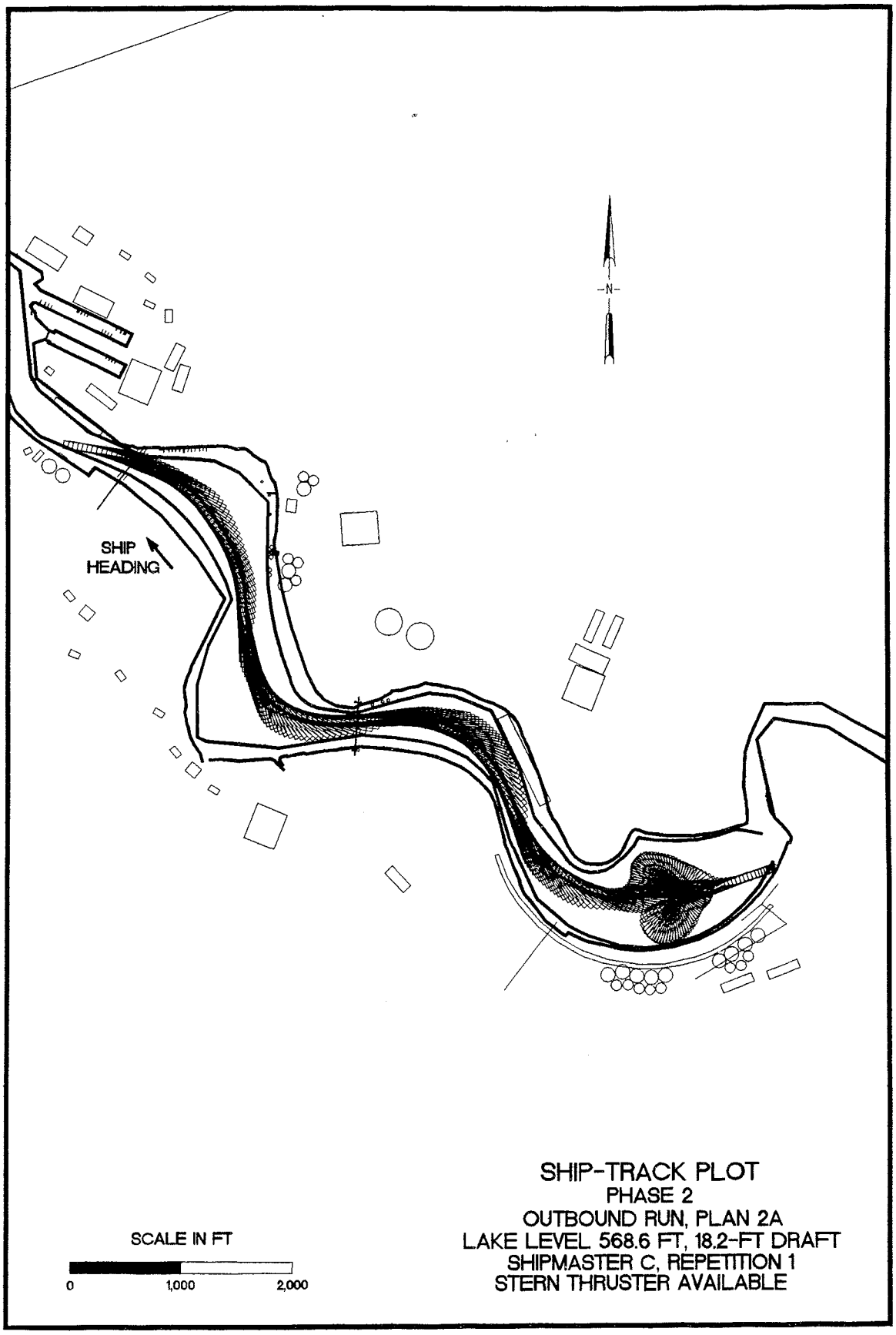
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 2A
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER C, REPETITION 2
STERN THRUSTER AVAILABLE



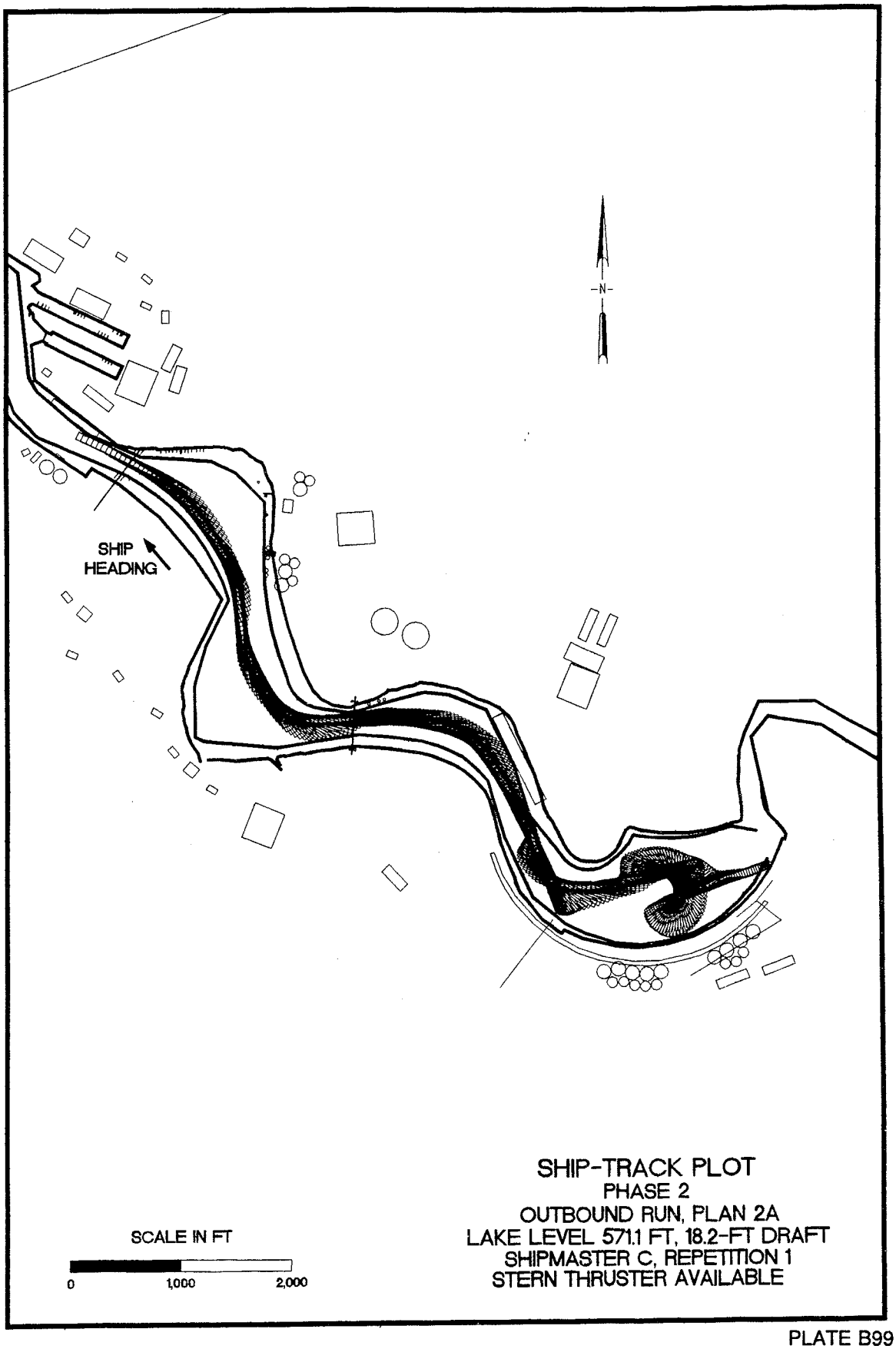
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 2A
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER C, REPETITION 1
STERN THRUSTER NOT AVAILABLE



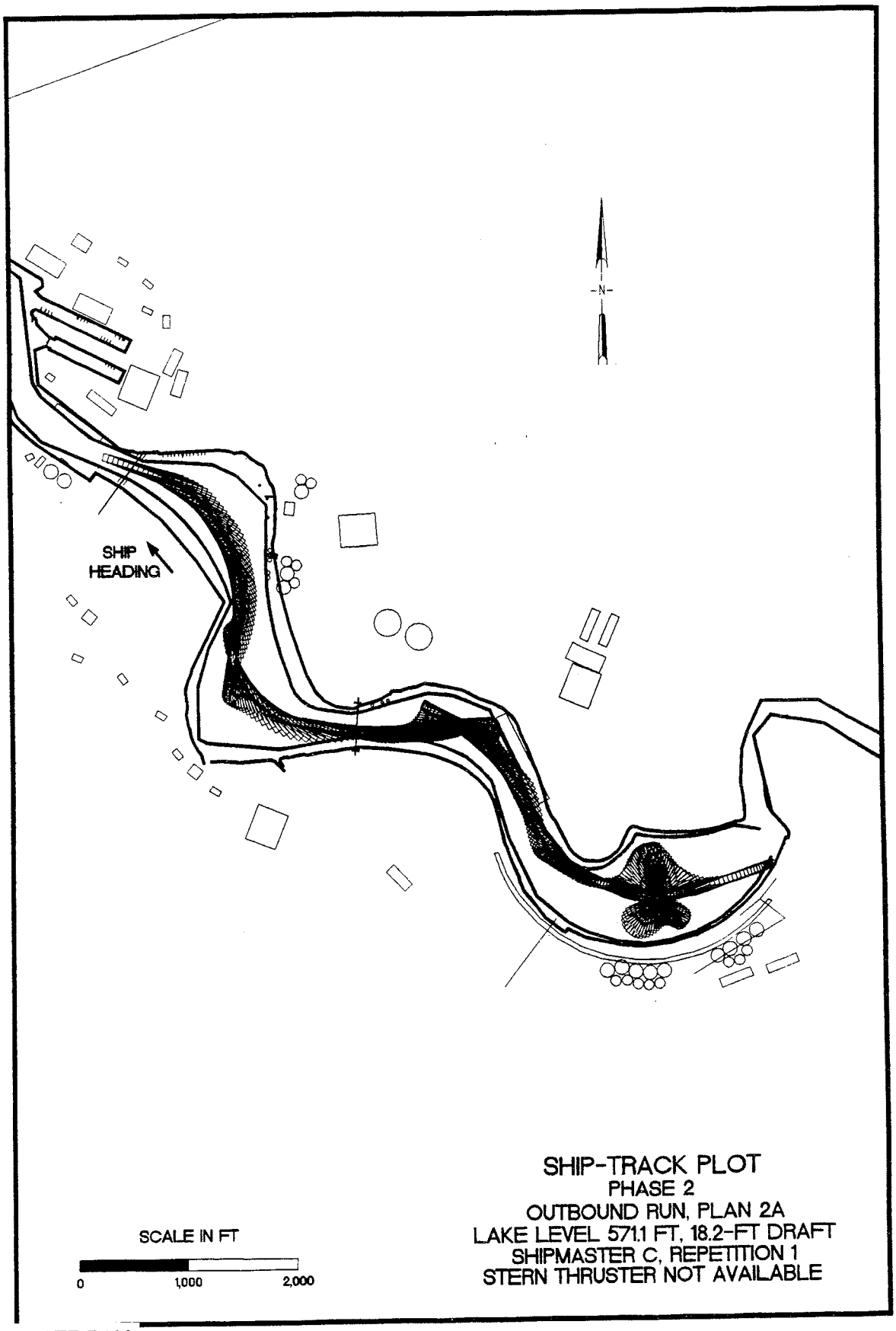
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 2A
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER C, REPETITION 1
STERN THRUSTER NOT AVAILABLE



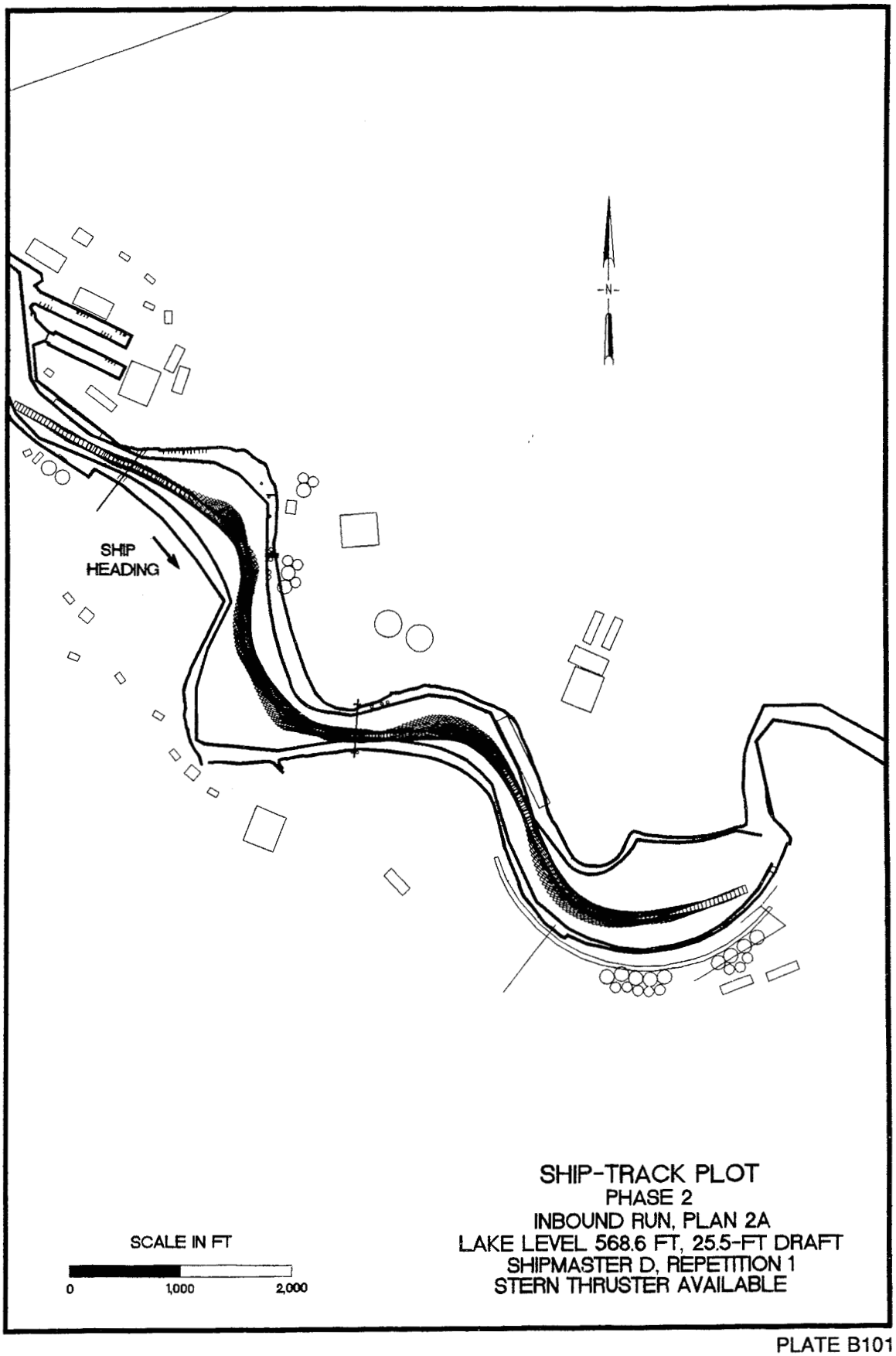
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 2A
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER C, REPETITION 1
STERN THRUSTER AVAILABLE



SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 2A
LAKE LEVEL 571.1 FT, 18.2-FT DRAFT
SHIPMASTER C, REPETITION 1
STERN THRUSTER AVAILABLE



SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 2A
LAKE LEVEL 571.1 FT, 18.2-FT DRAFT
SHIPMASTER C, REPETITION 1
STERN THRUSTER NOT AVAILABLE



SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 2A
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER D, REPETITION 1
STERN THRUSTER AVAILABLE

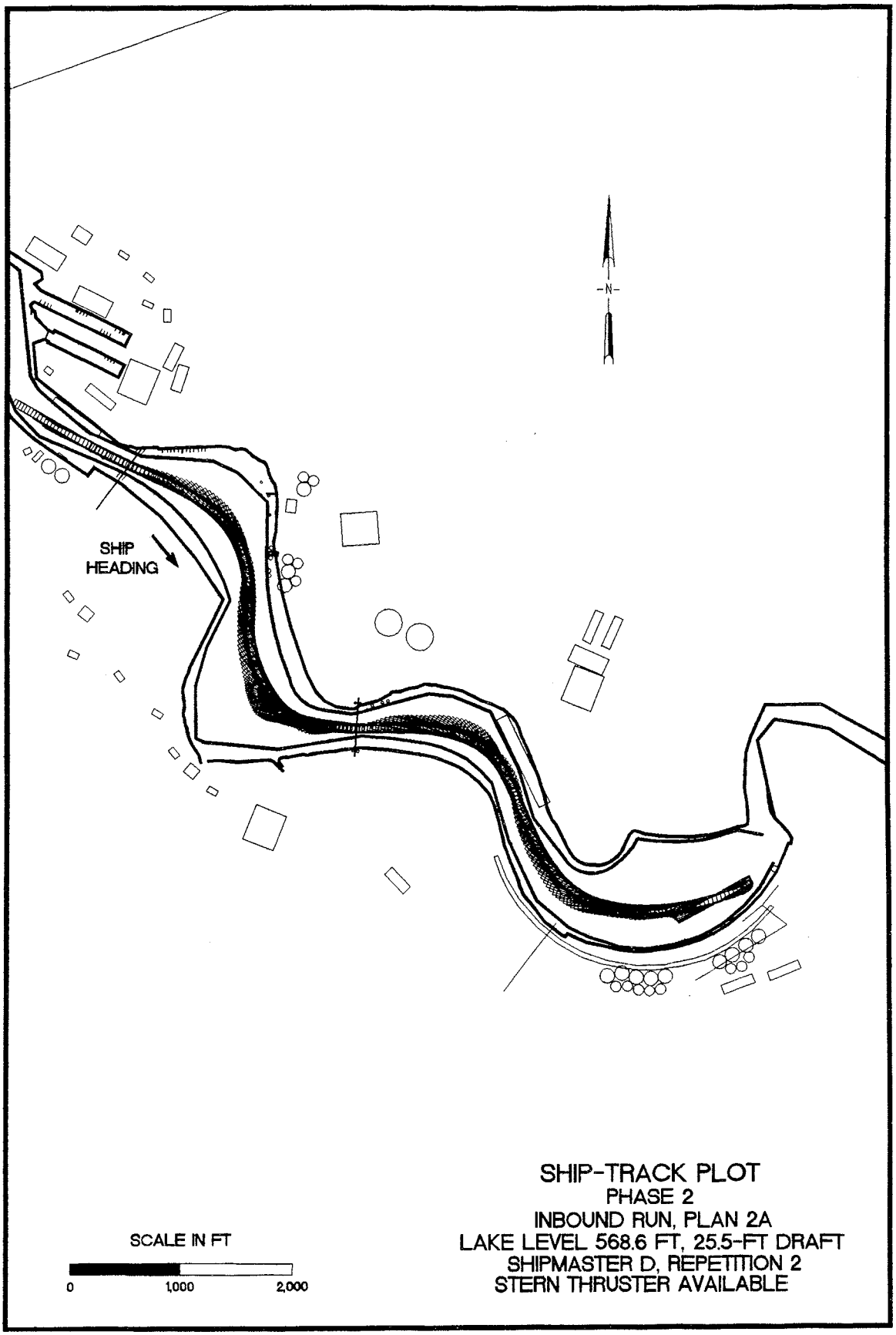
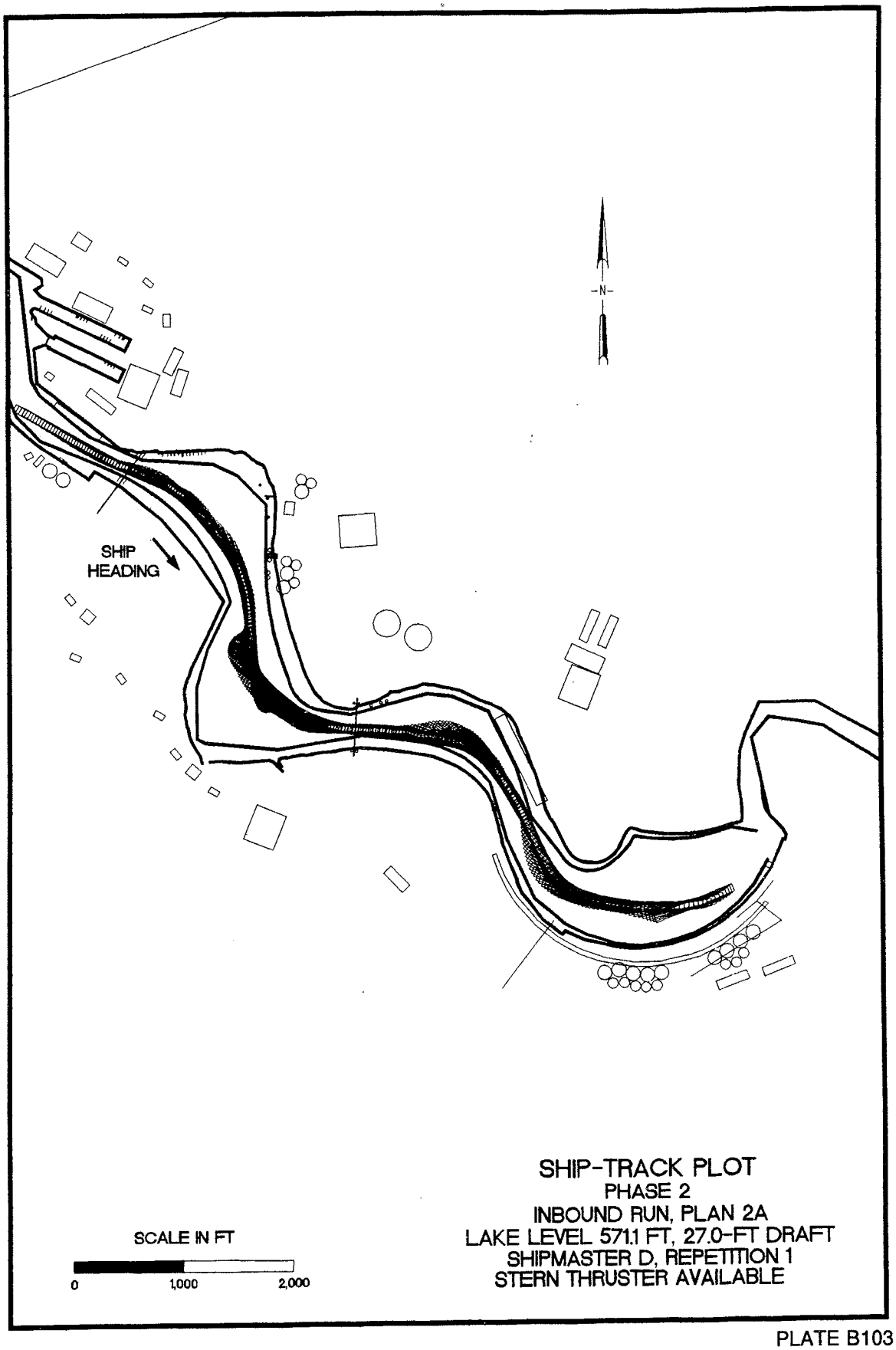
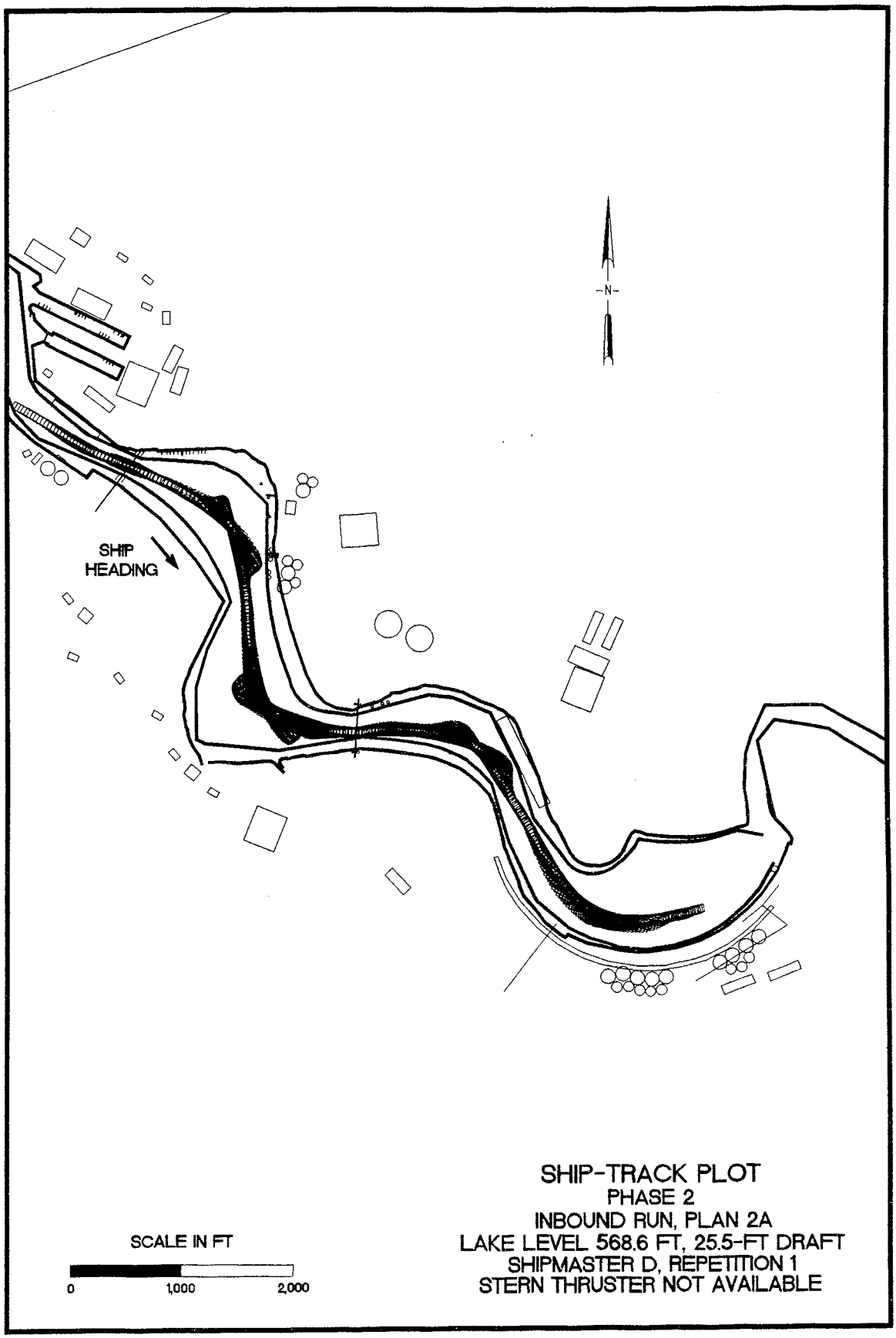

N
SHIP
HEADING
SCALE IN FT
0
1,000
2,000
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 2A
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER D, REPETITION 2
STERN THRUSTER AVAILABLE

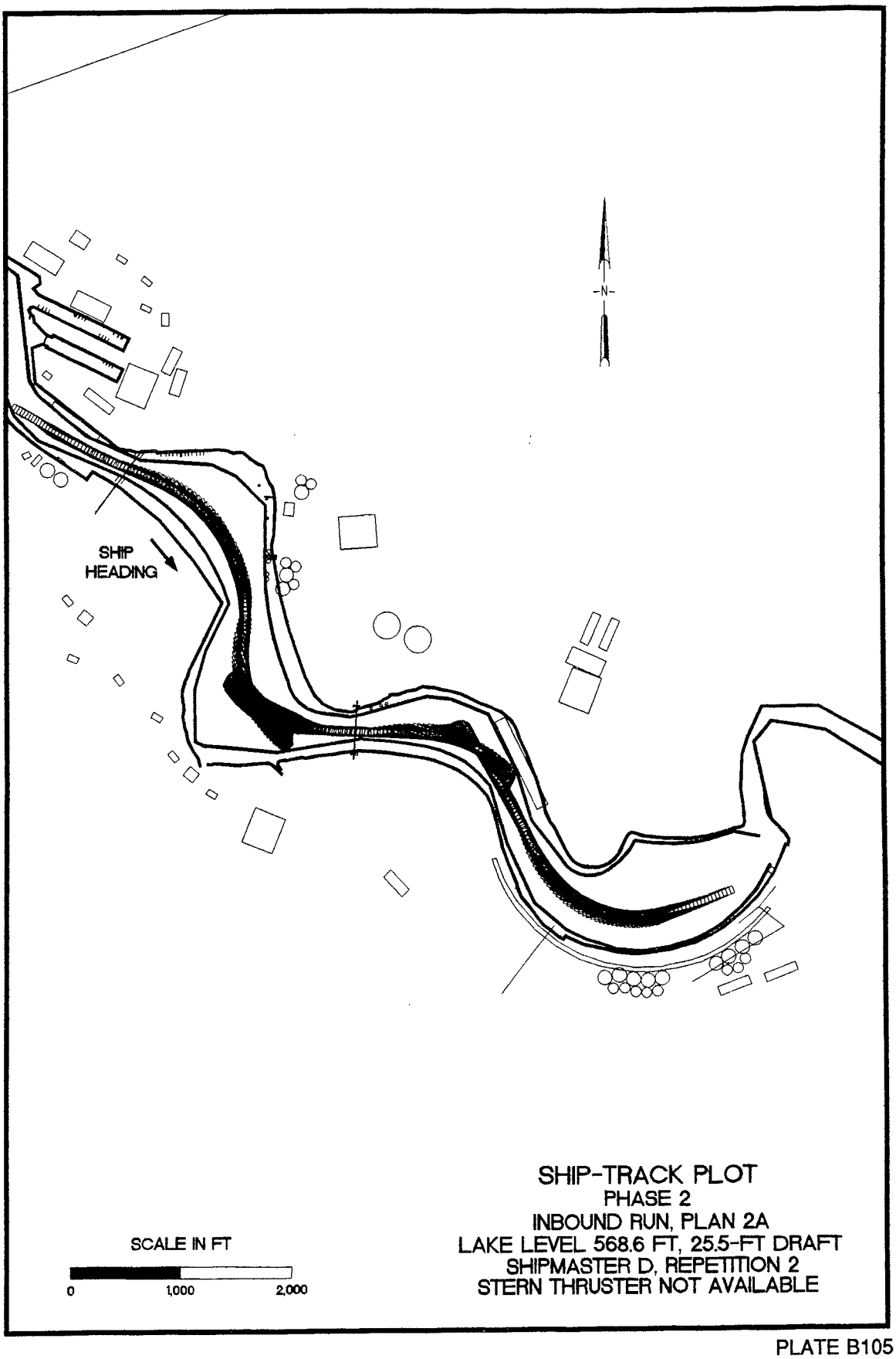
PLATE B102



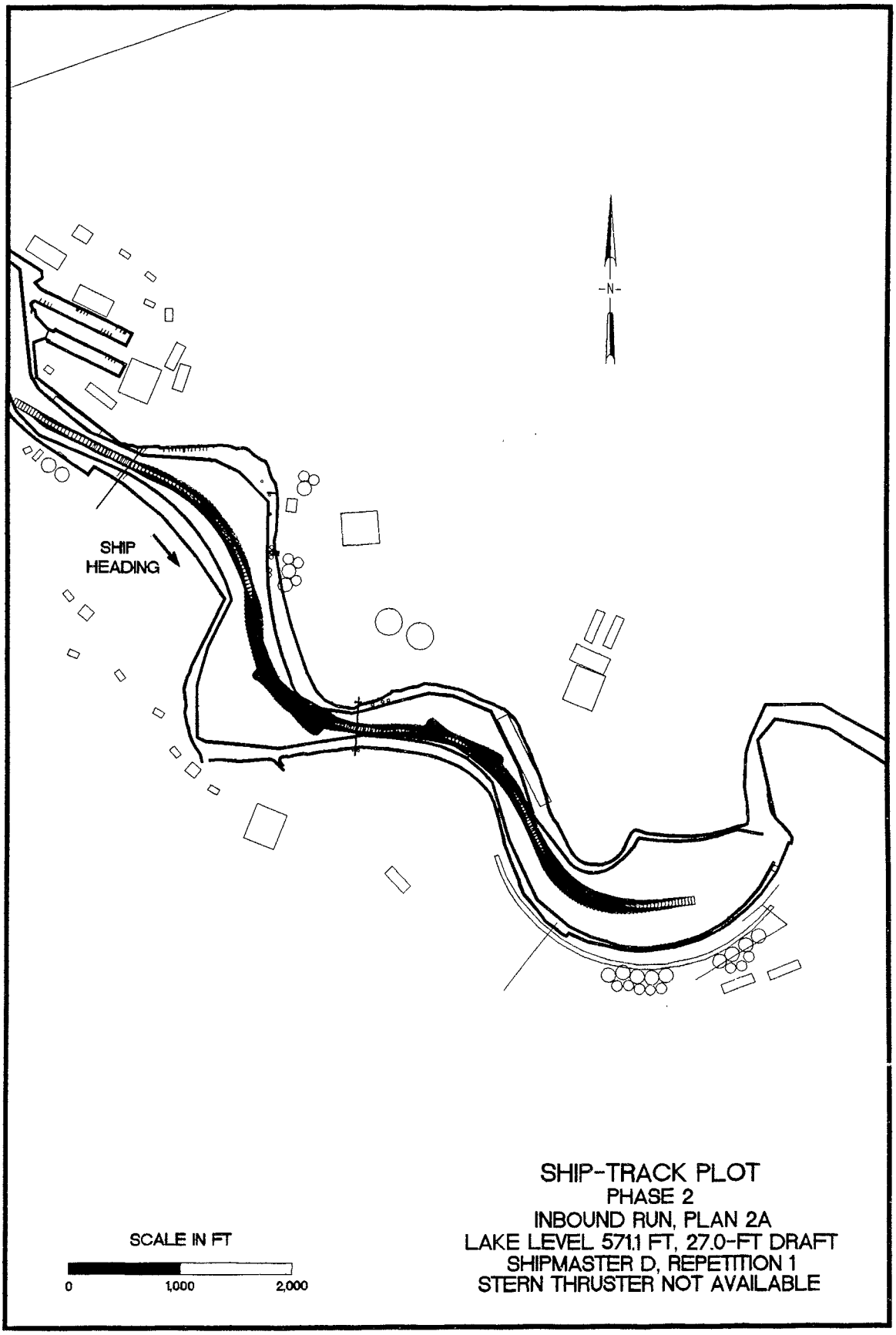
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 2A
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER D, REPETITION 1
STERN THRUSTER AVAILABLE



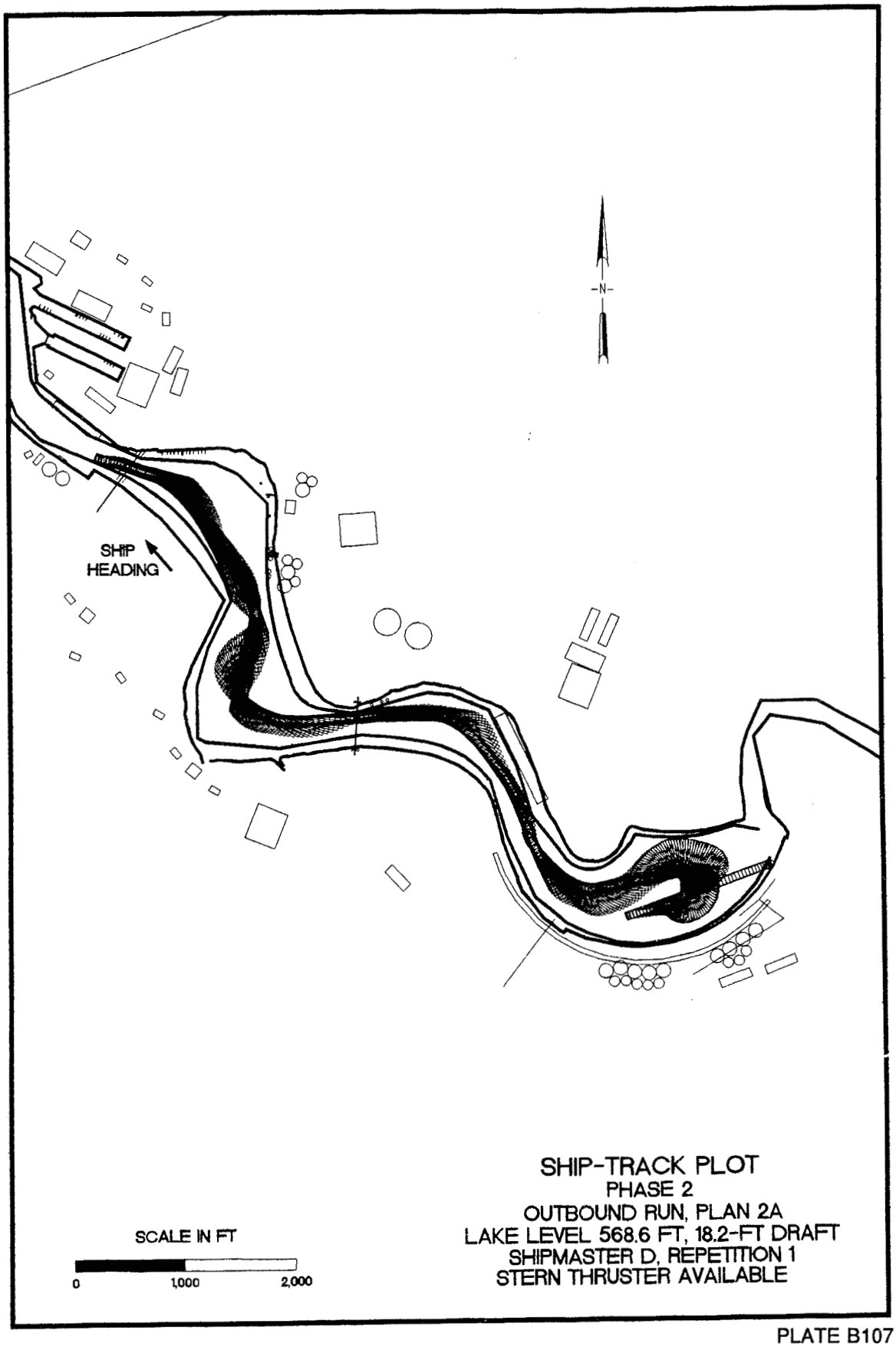
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 2A
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER D, REPETITION 1
STERN THRUSTER NOT AVAILABLE



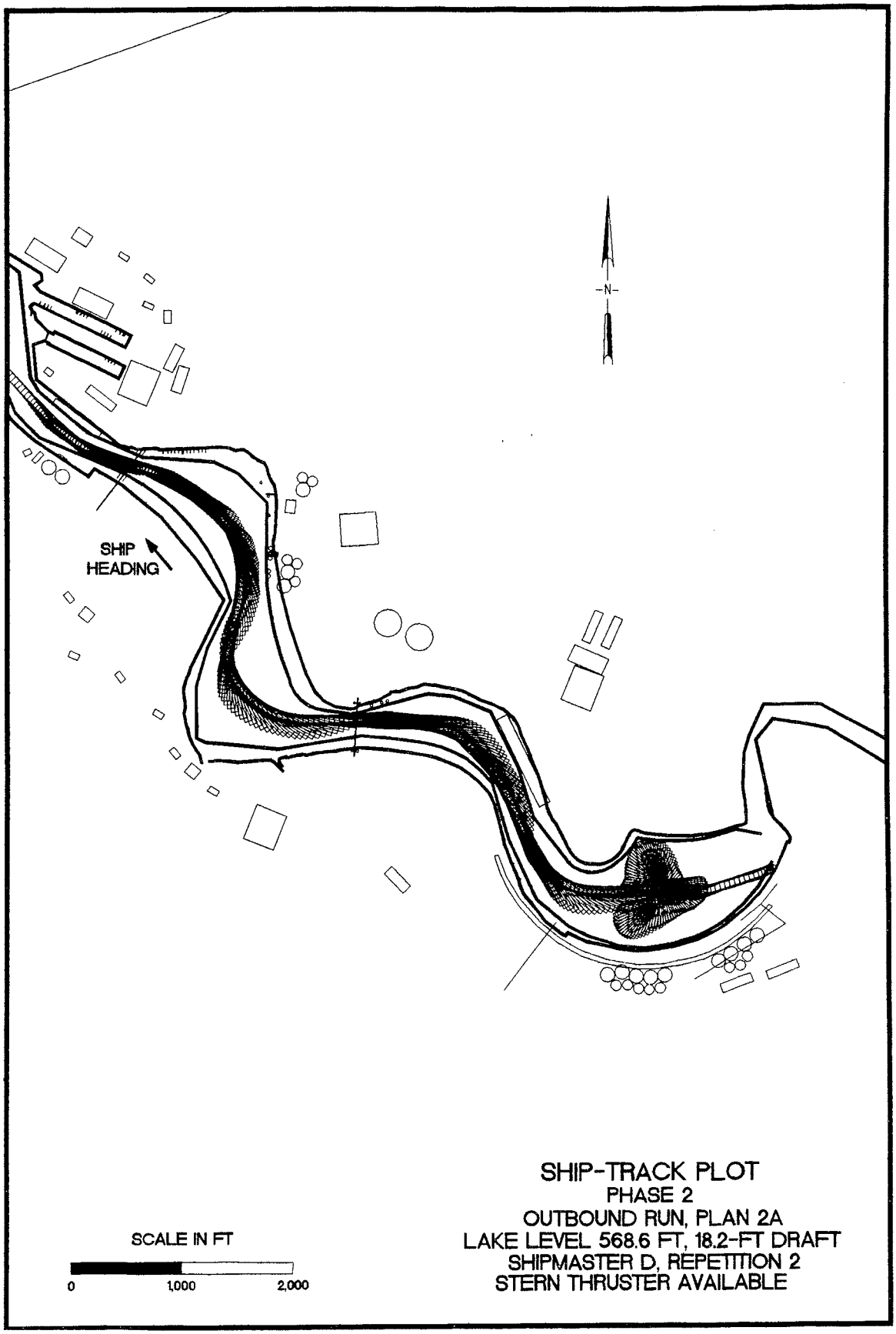
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 2A
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER D, REPETITION 2
STERN THRUSTER NOT AVAILABLE



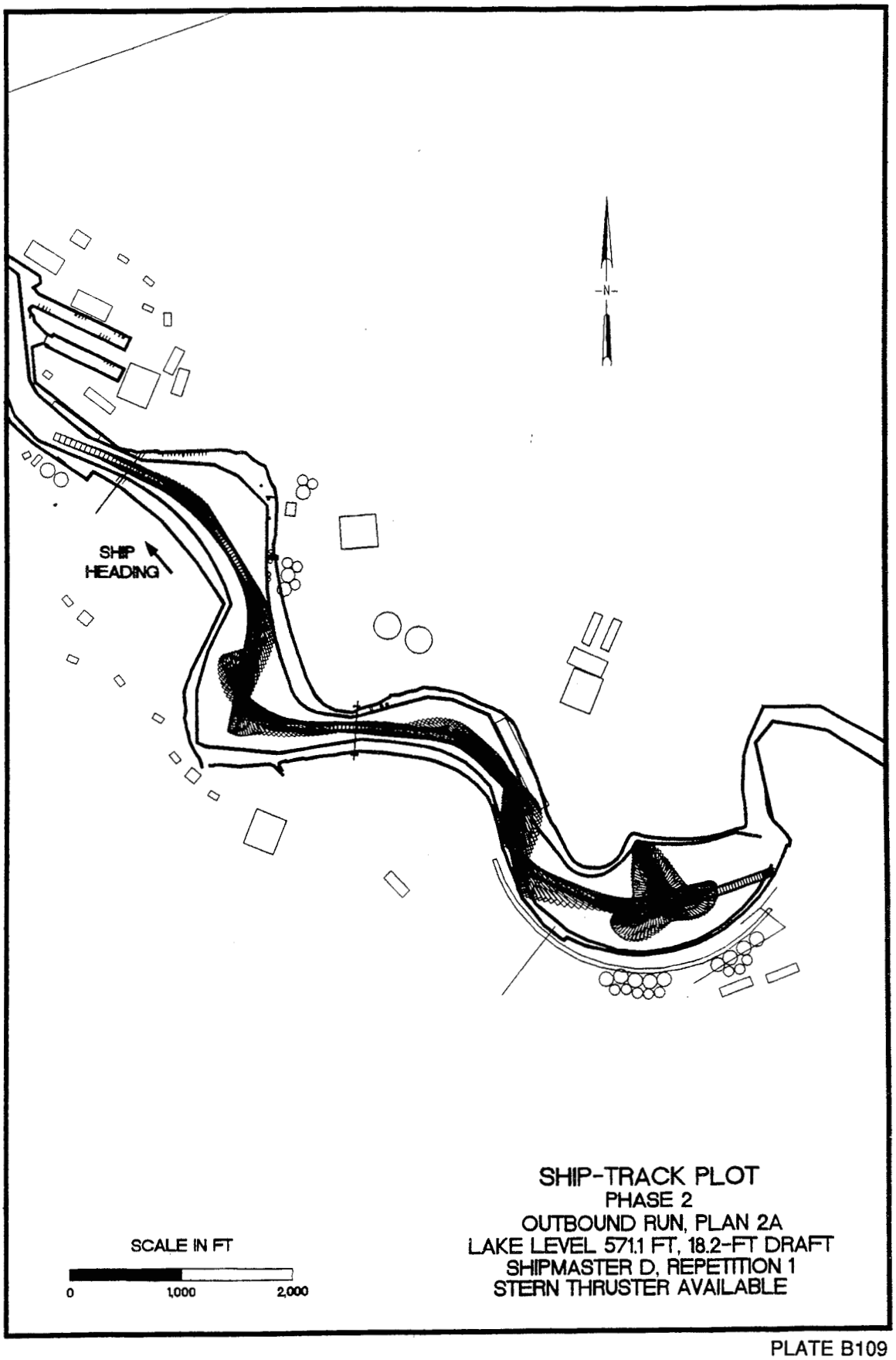
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 2A
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER D, REPETITION 1
STERN THRUSTER NOT AVAILABLE



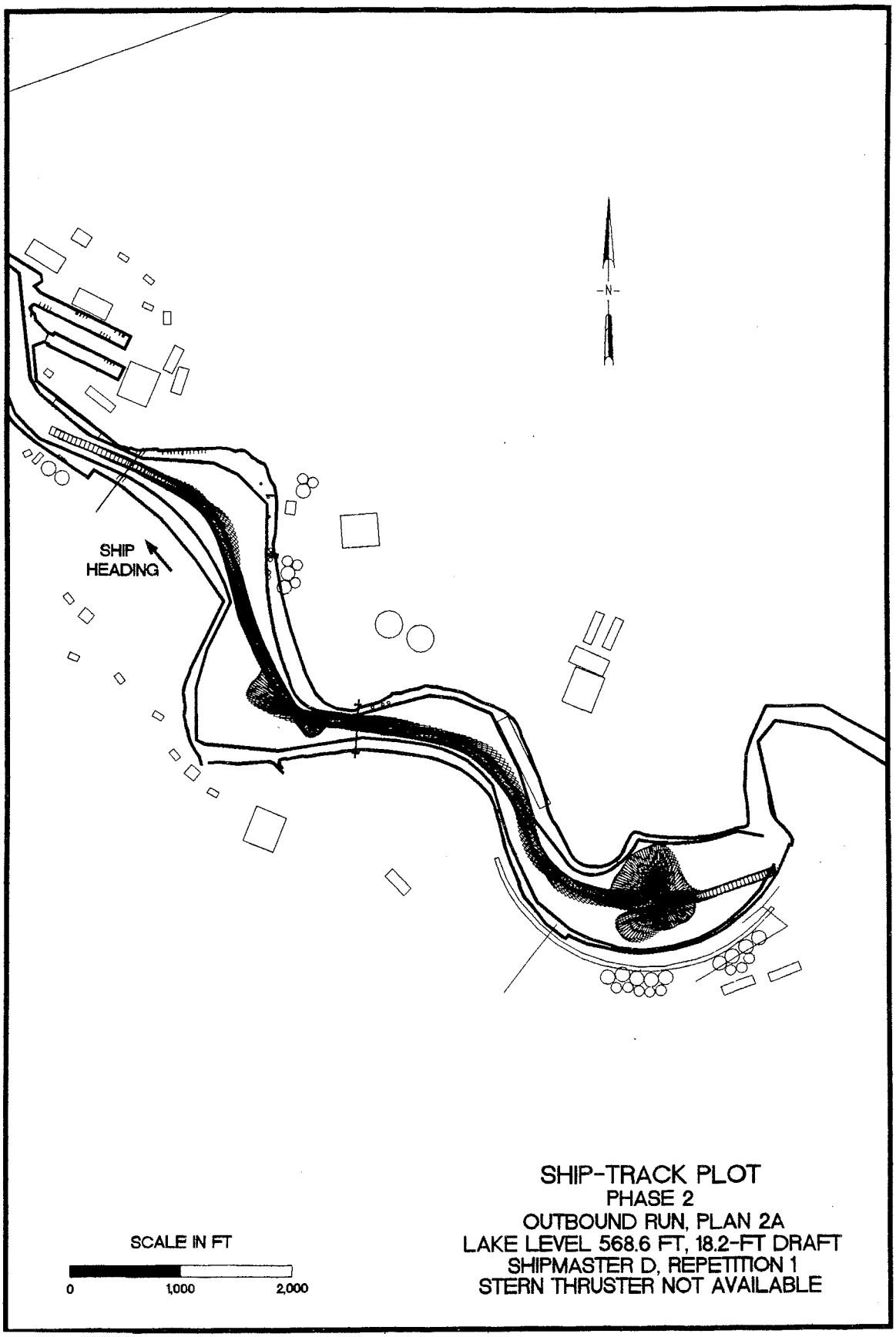
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 2A
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER D, REPETITION 1
STERN THRUSTER AVAILABLE



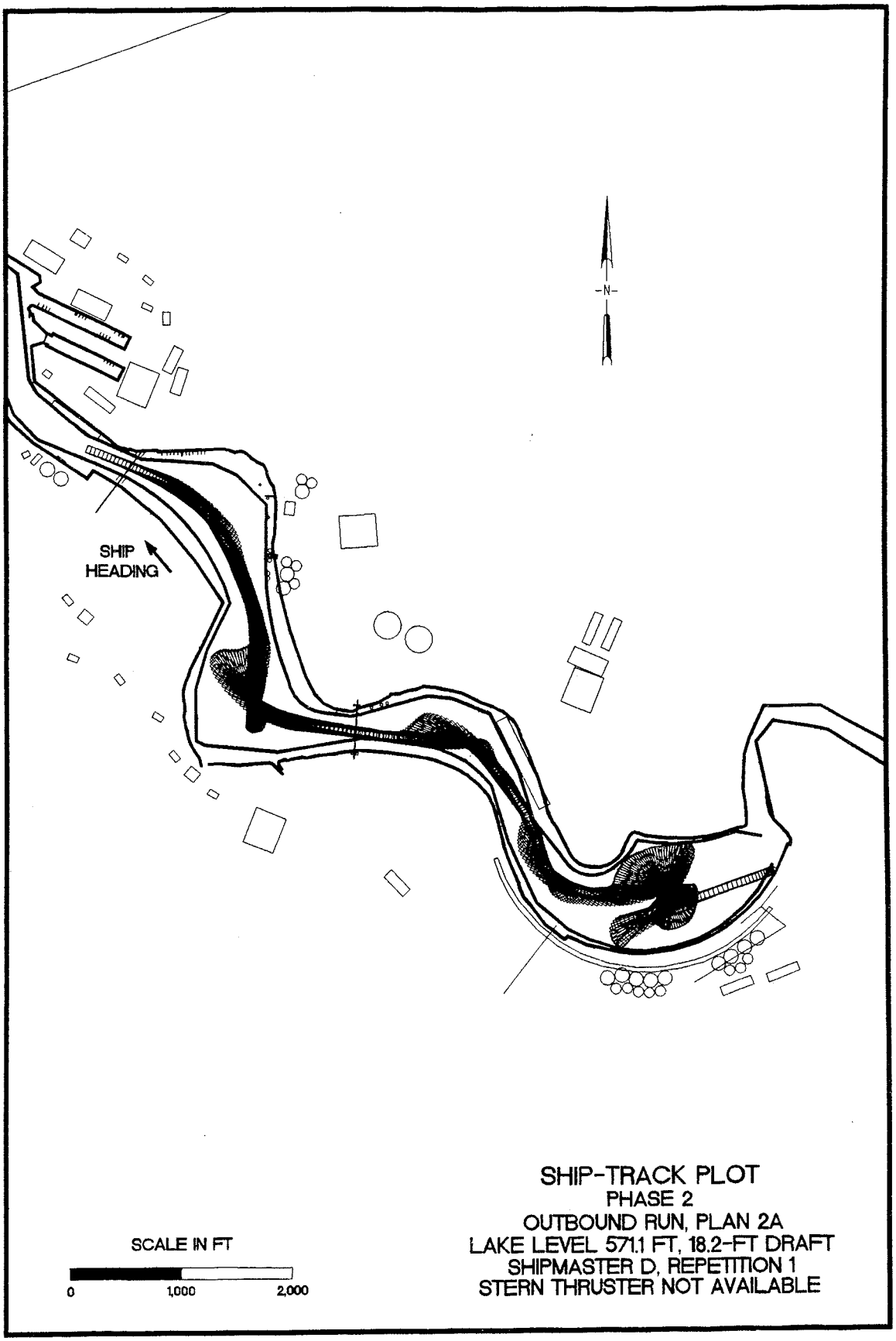
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 2A
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER D, REPETITION 2
STERN THRUSTER AVAILABLE



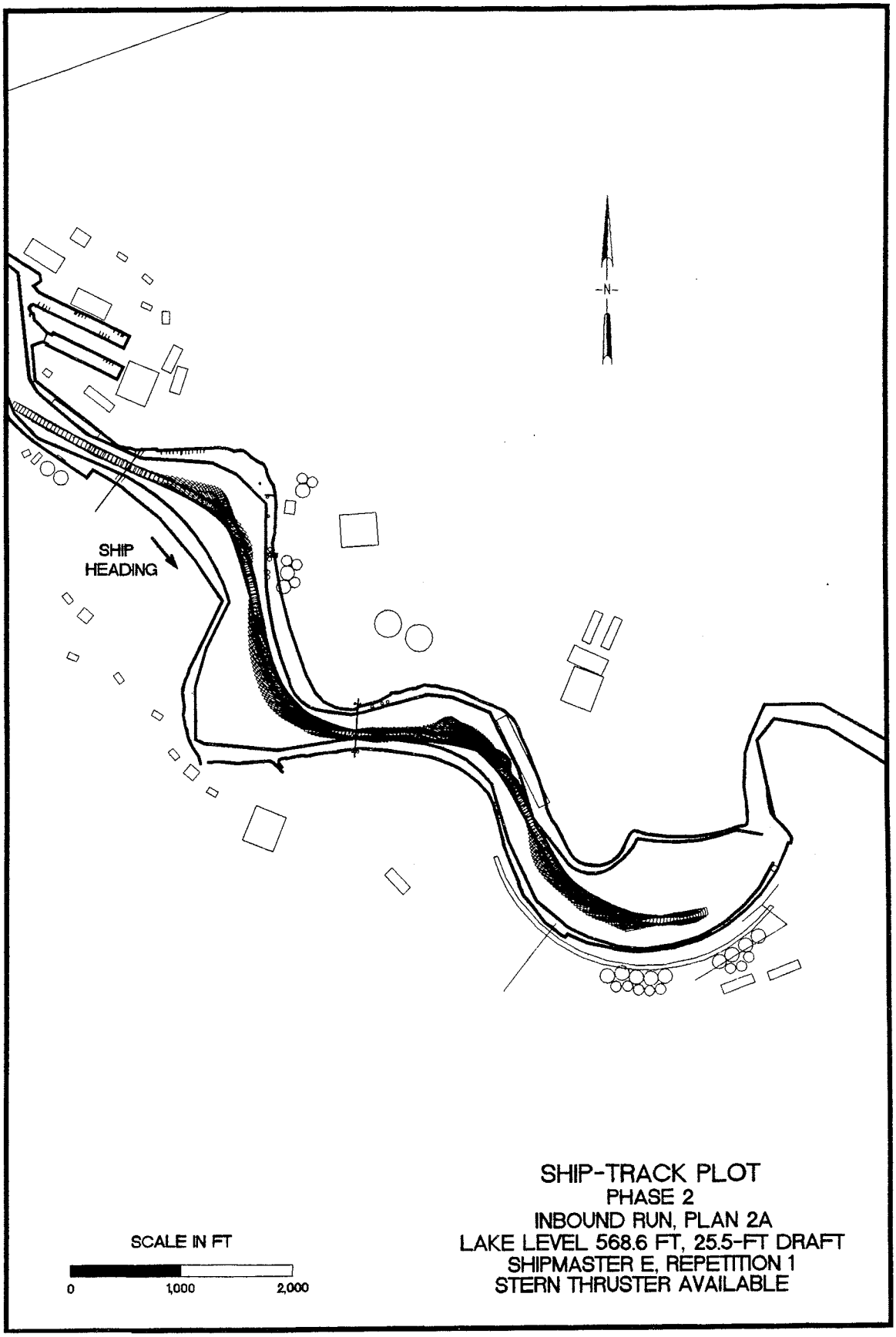
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 2A
LAKE LEVEL 571.1 FT, 18.2-FT DRAFT
SHIPMASTER D, REPETITION 1
STERN THRUSTER AVAILABLE



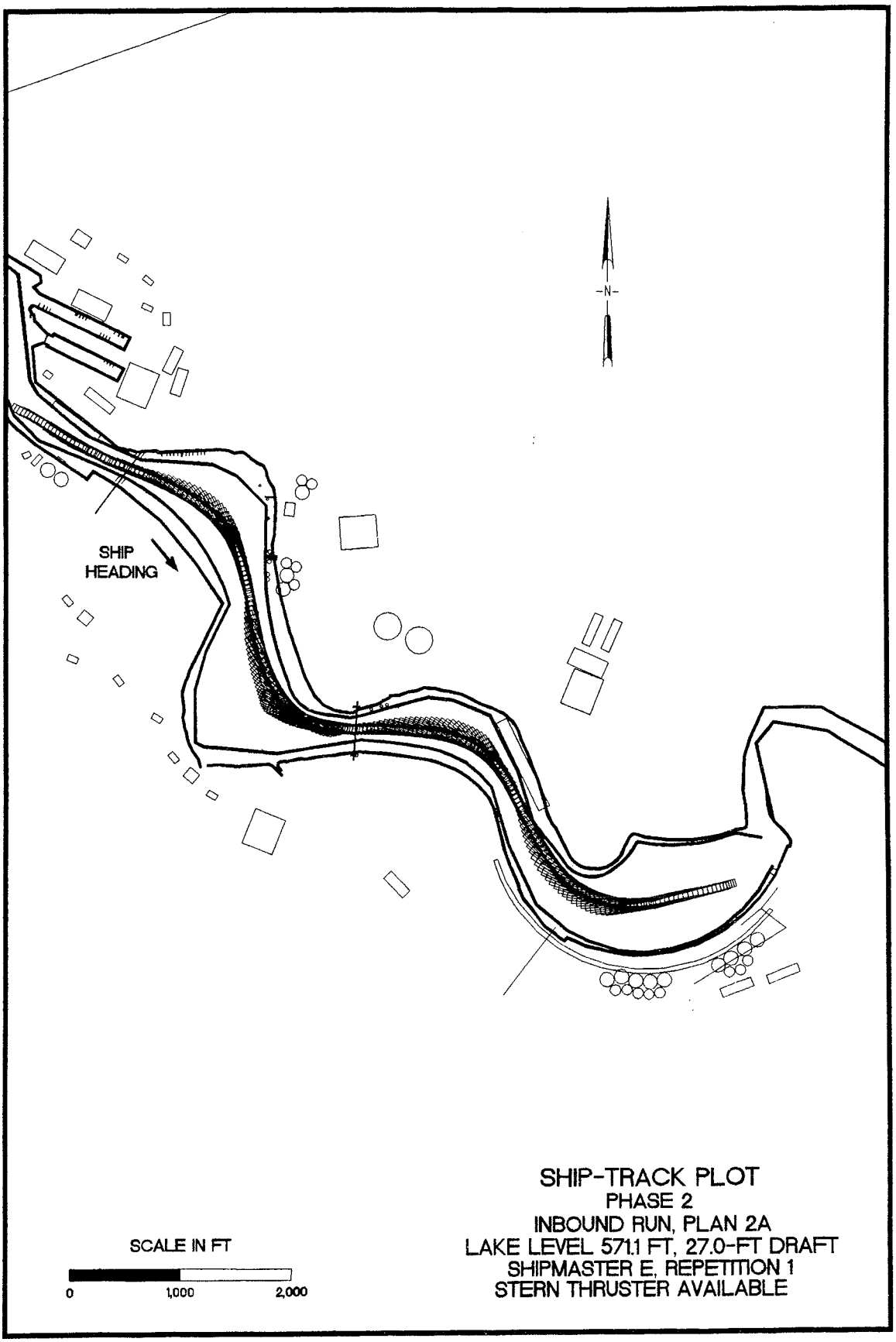
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 2A
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER D, REPETITION 1
STERN THRUSTER NOT AVAILABLE



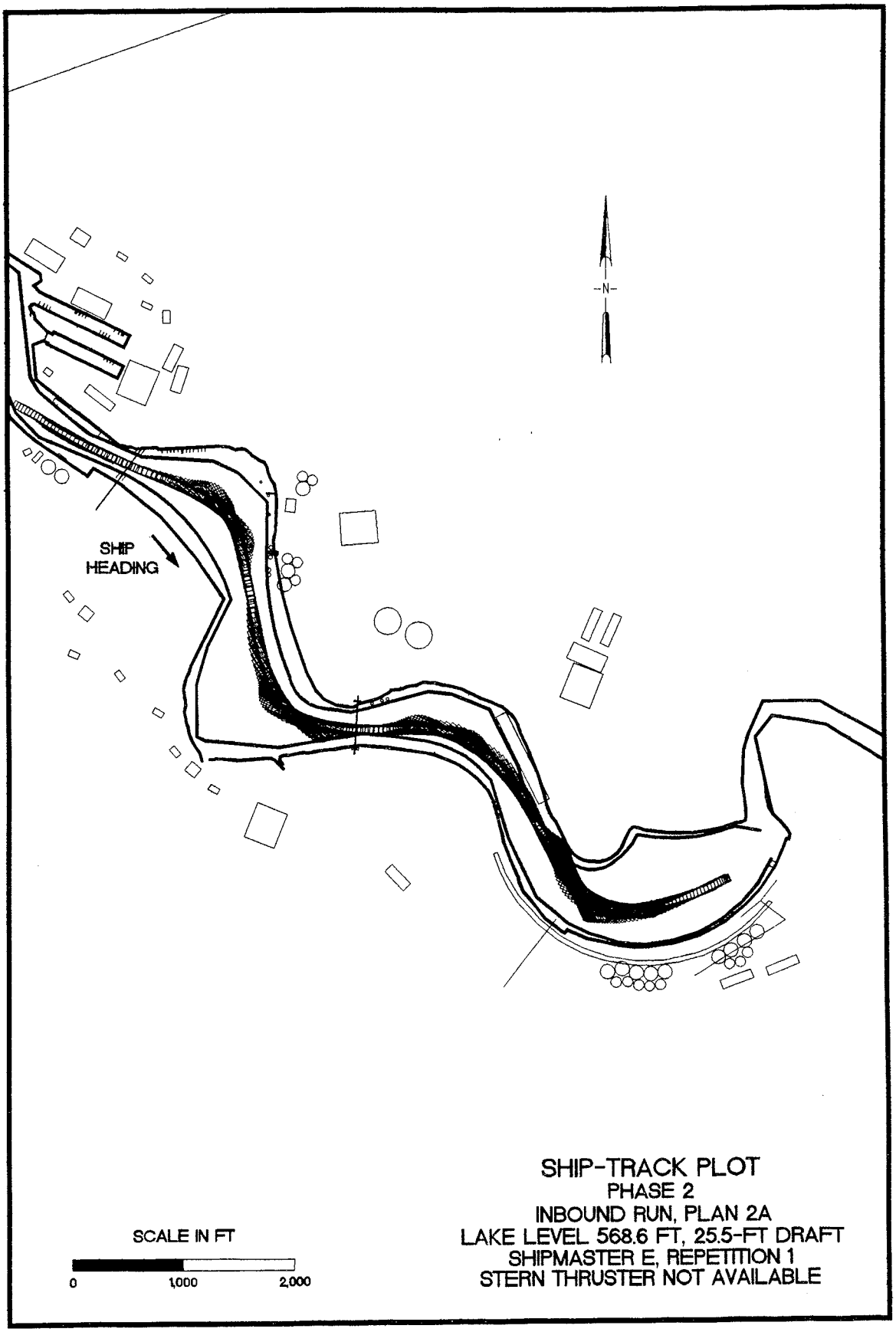
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 2A
LAKE LEVEL 571.1 FT, 18.2-FT DRAFT
SHIPMASTER D, REPETITION 1
STERN THRUSTER NOT AVAILABLE



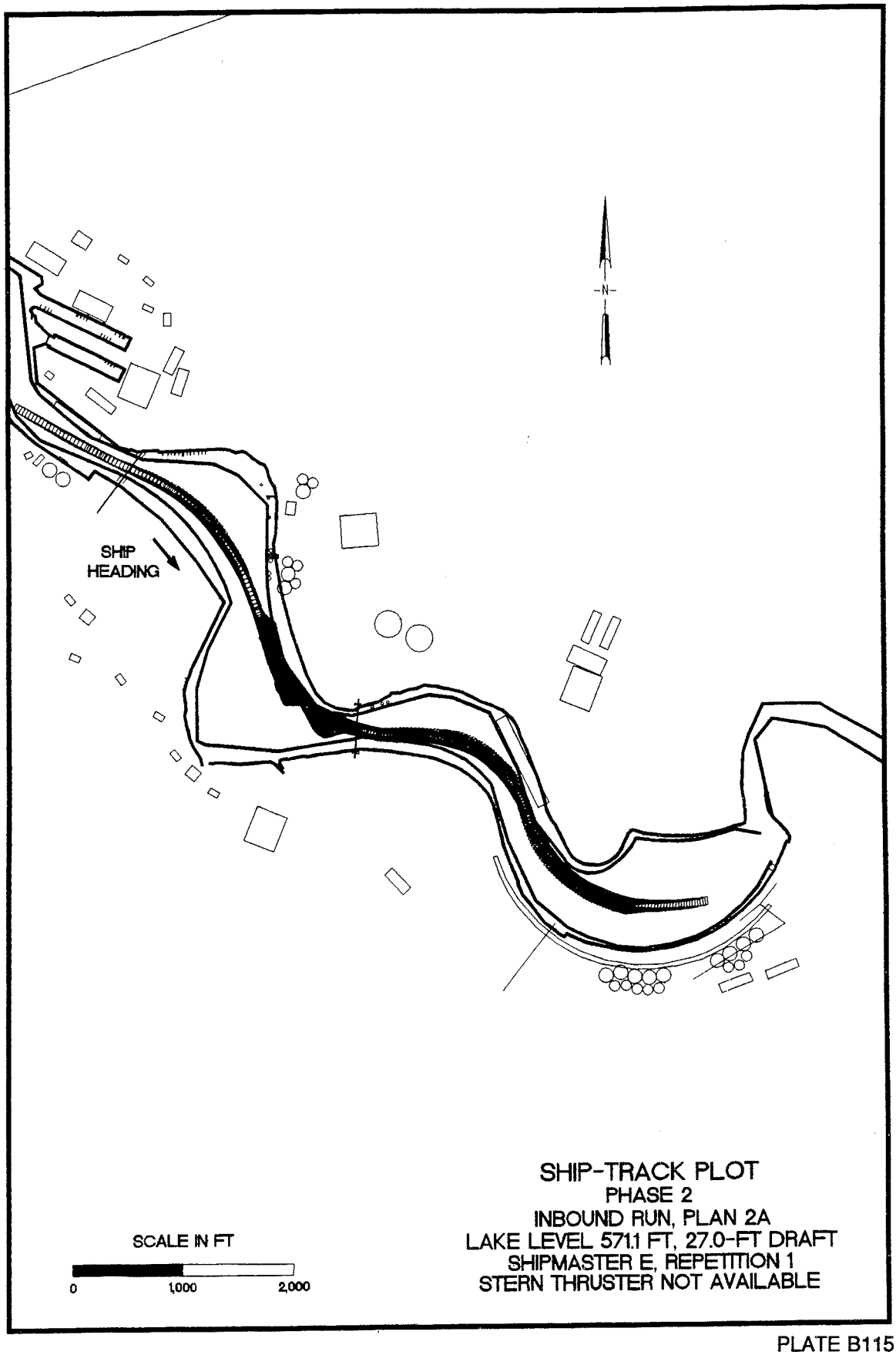
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 2A
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER E, REPETITION 1
STERN THRUSTER AVAILABLE



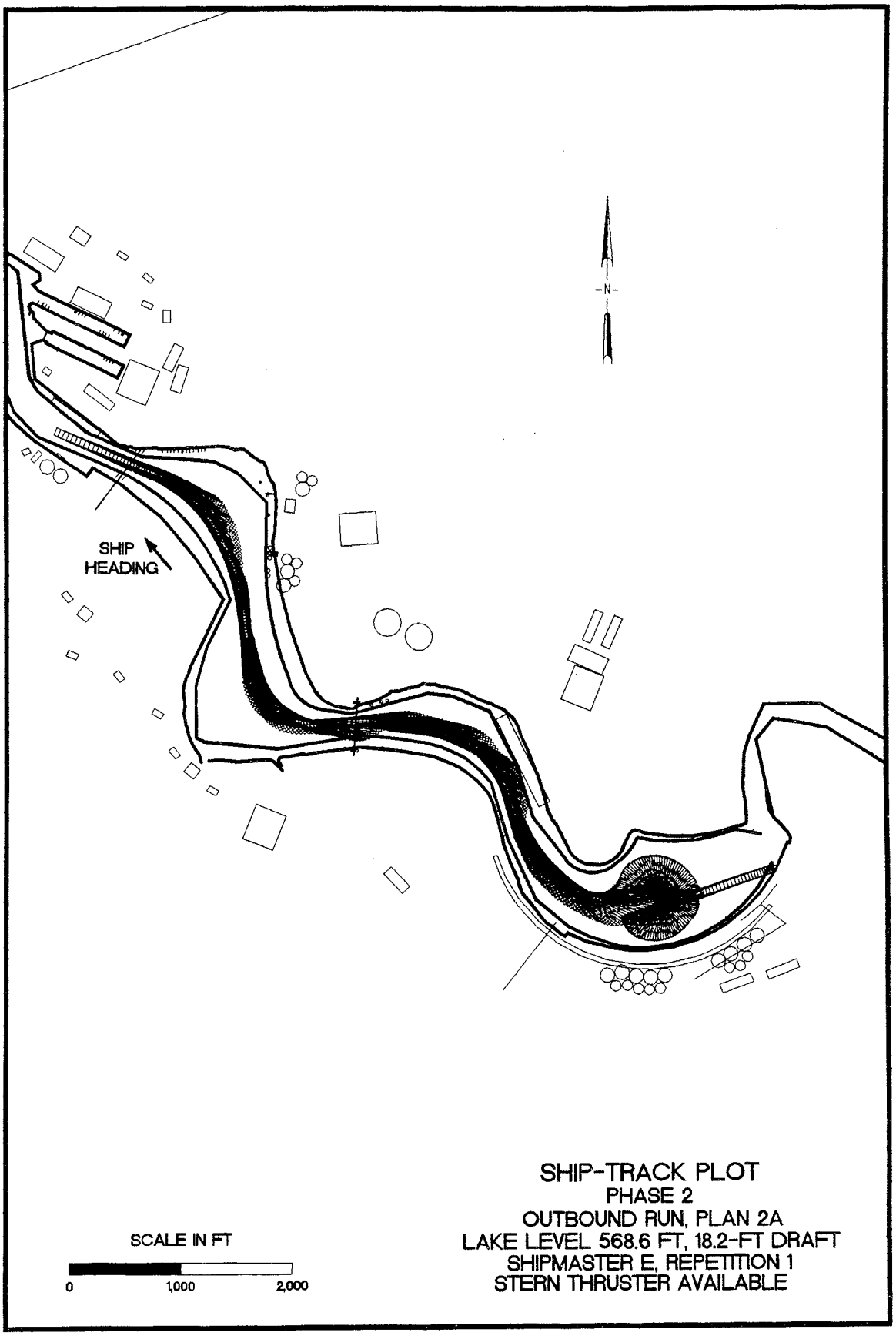
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 2A
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER E, REPETITION 1
STERN THRUSTER AVAILABLE



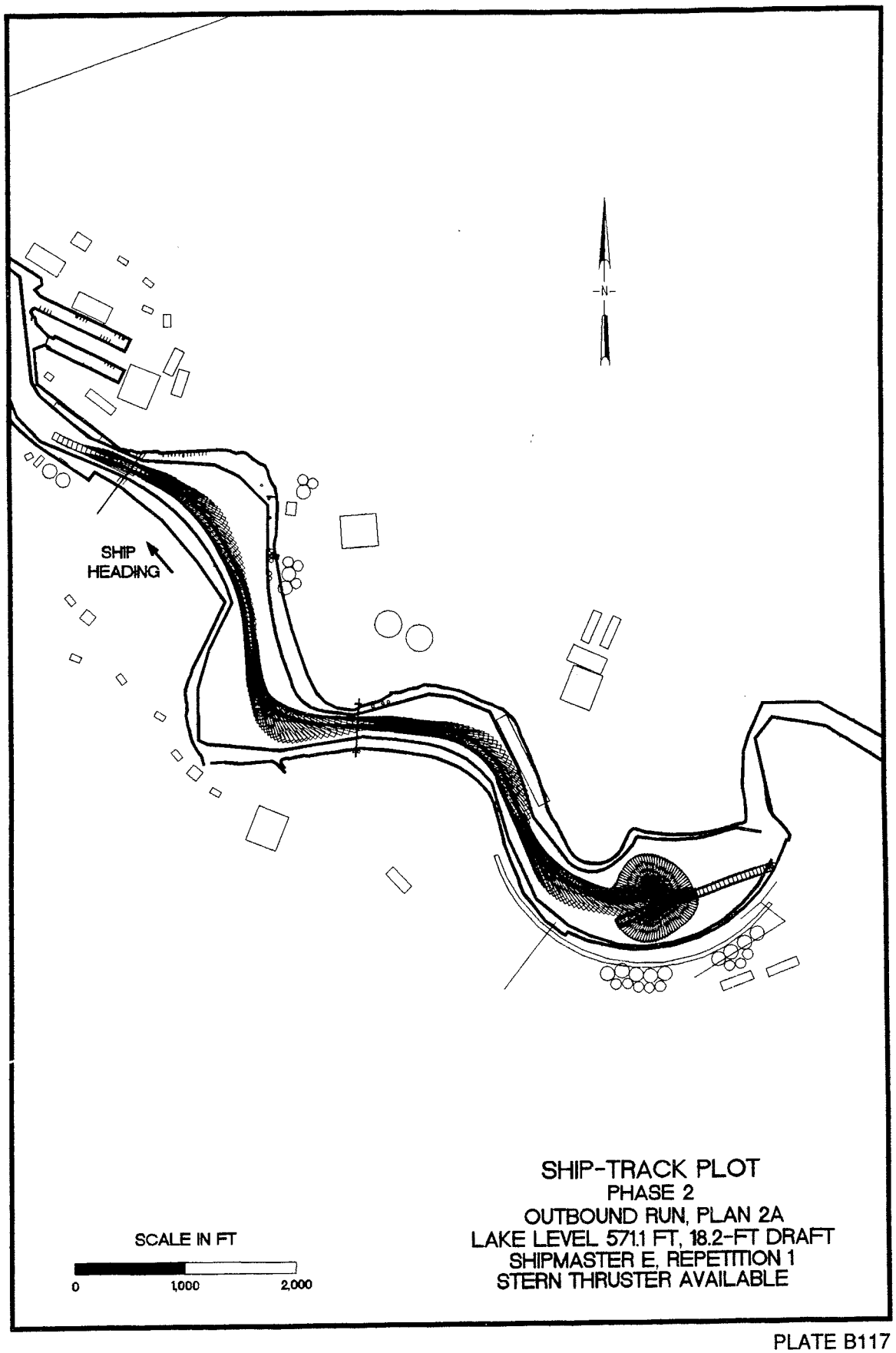
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 2A
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER E, REPETITION 1
STERN THRUSTER NOT AVAILABLE



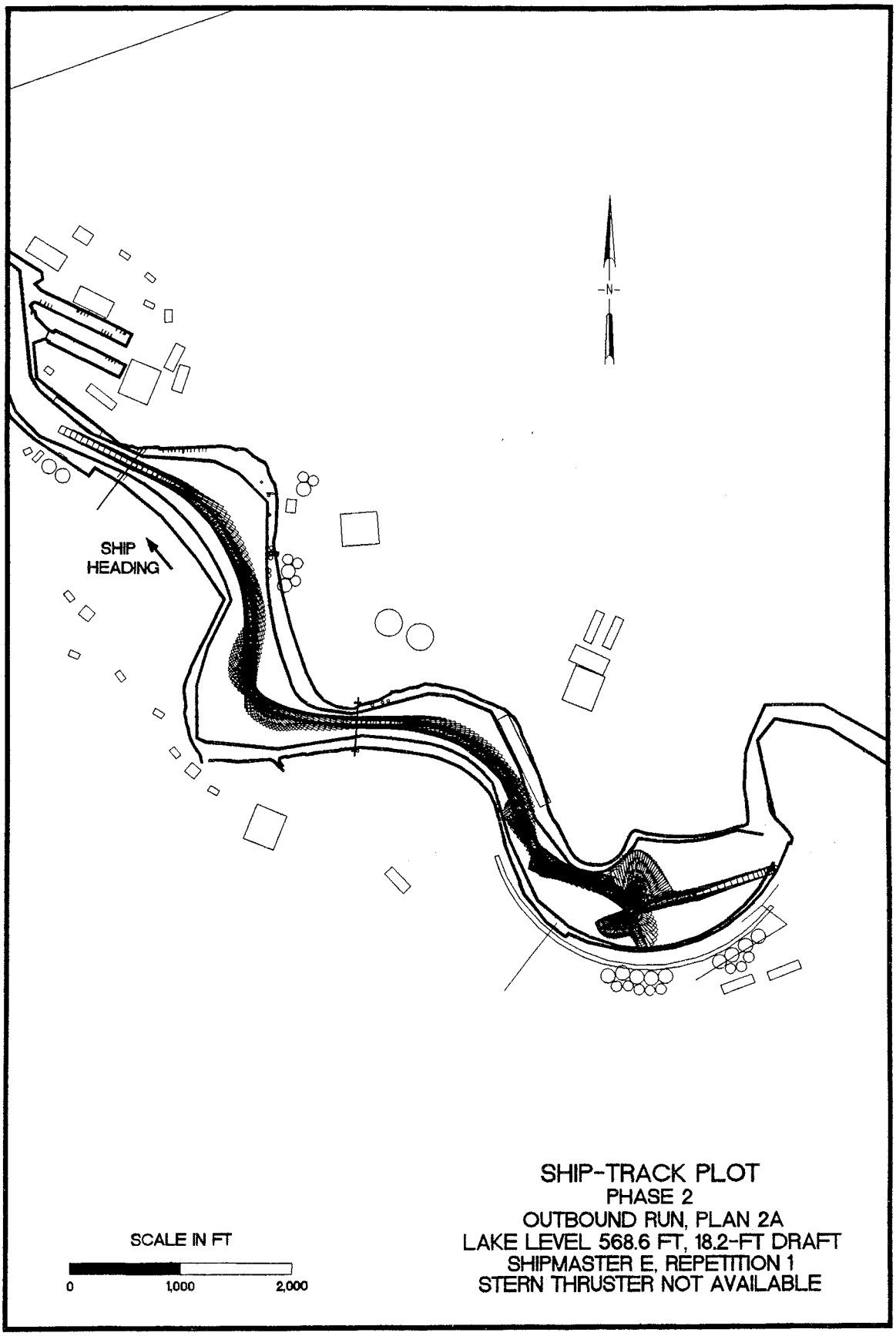
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 2A
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER E, REPETITION 1
STERN THRUSTER NOT AVAILABLE



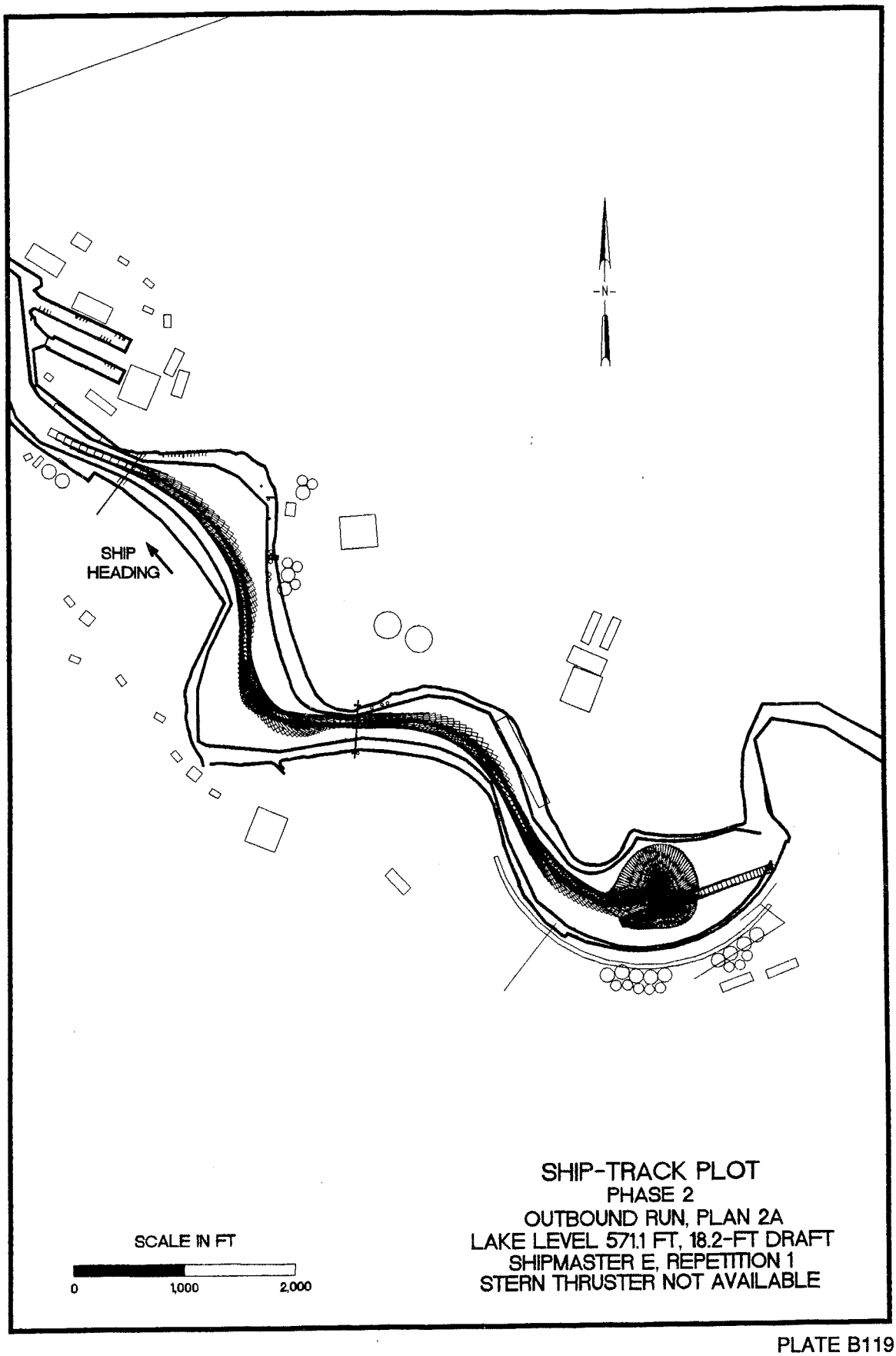
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 2A
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER E, REPETITION 1
STERN THRUSTER AVAILABLE



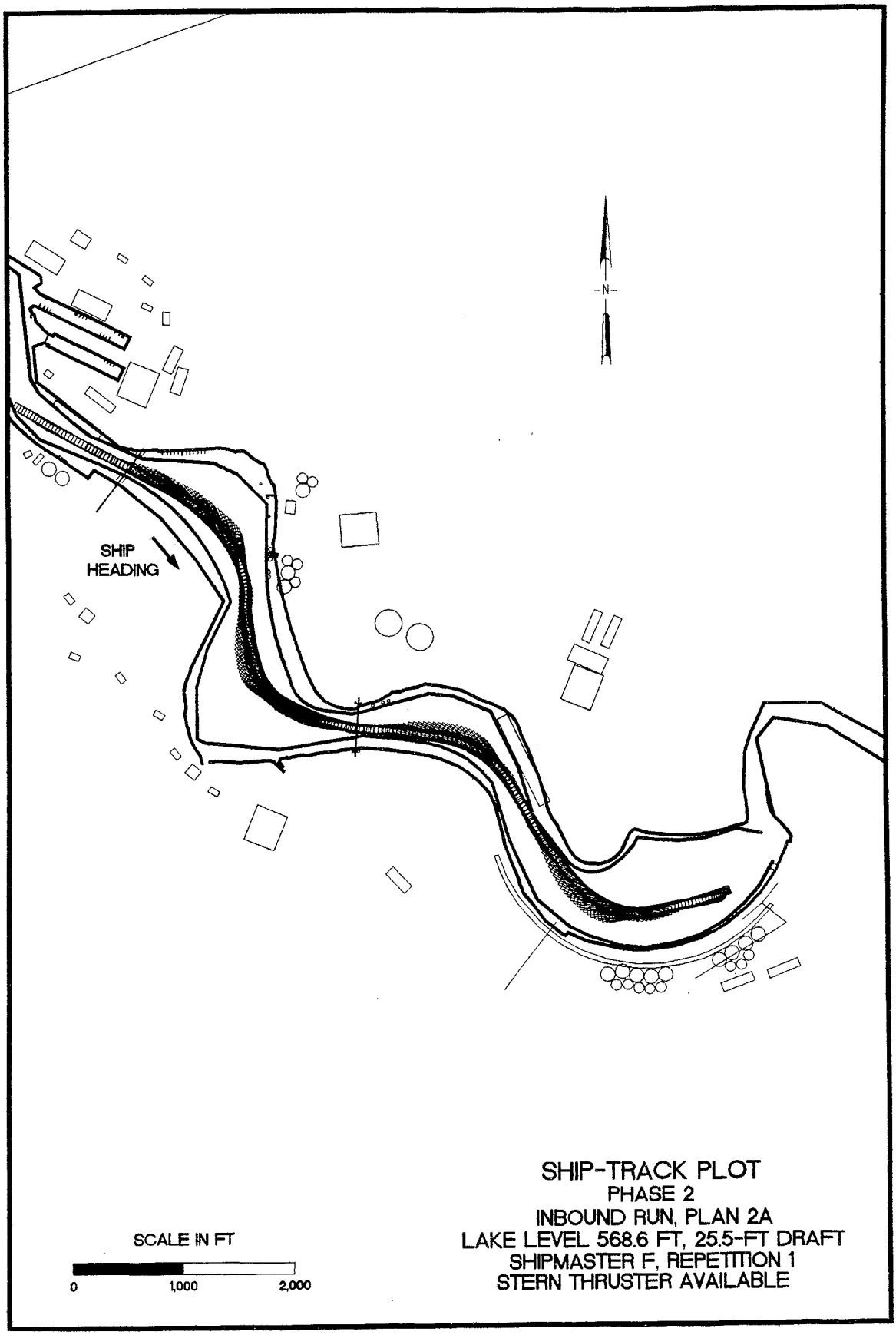
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 2A
LAKE LEVEL 571.1 FT, 18.2-FT DRAFT
SHIPMASTER E, REPETITION 1
STERN THRUSTER AVAILABLE



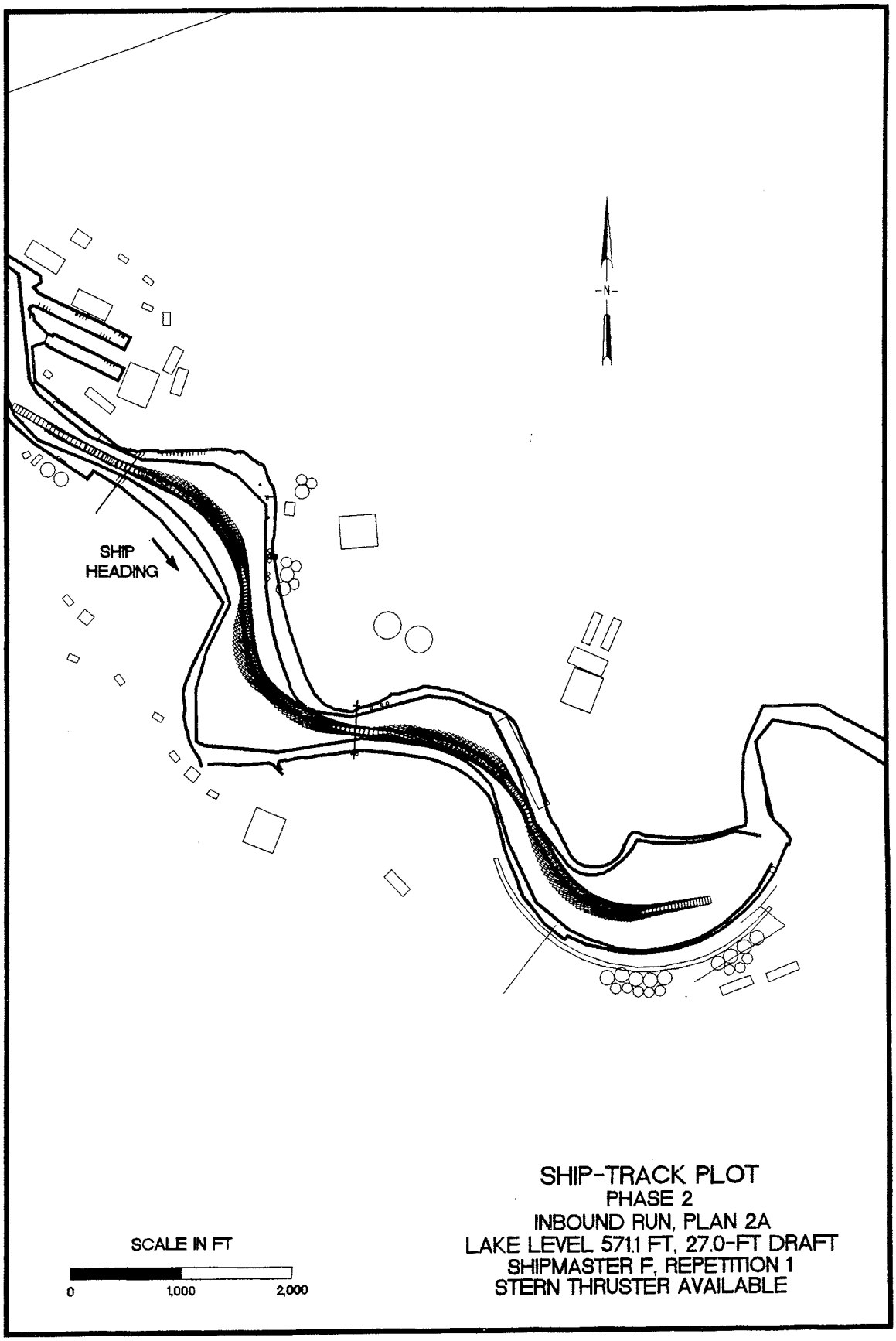
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 2A
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER E, REPETITION 1
STERN THRUSTER NOT AVAILABLE



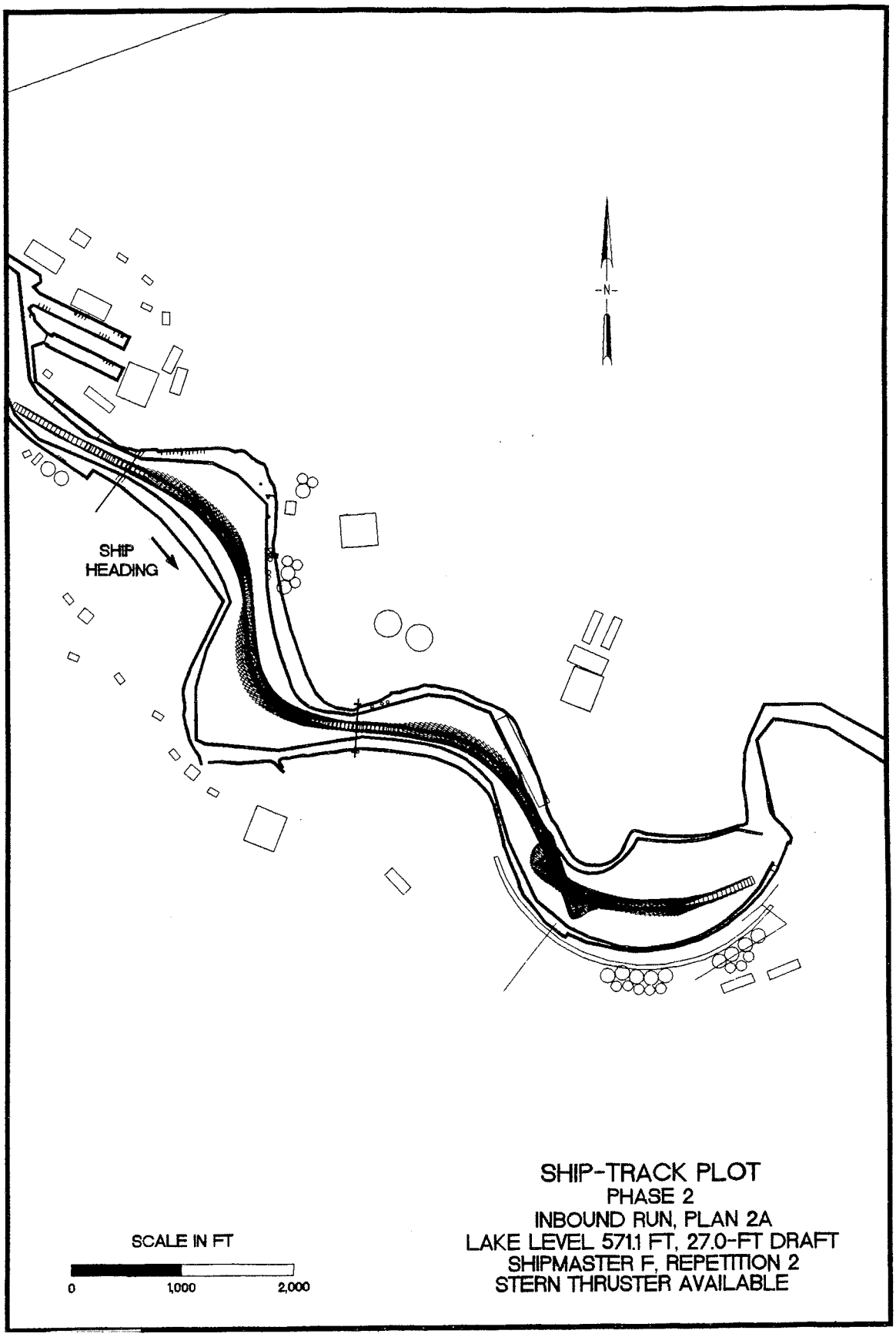
SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 2A
LAKE LEVEL 571.1 FT, 18.2-FT DRAFT
SHIPMASTER E, REPETITION 1
STERN THRUSTER NOT AVAILABLE



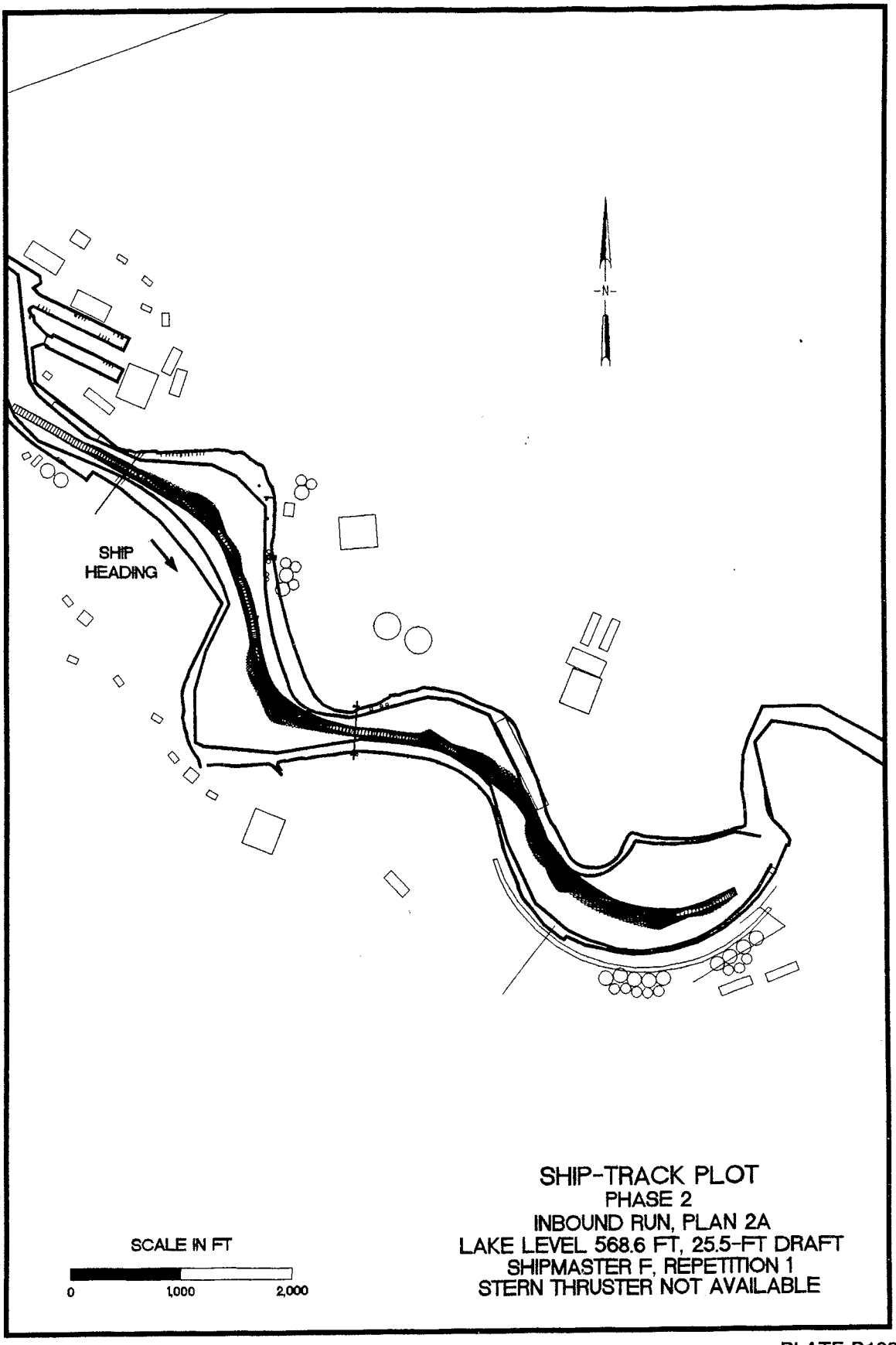
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 2A
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER F, REPETITION 1
STERN THRUSTER AVAILABLE



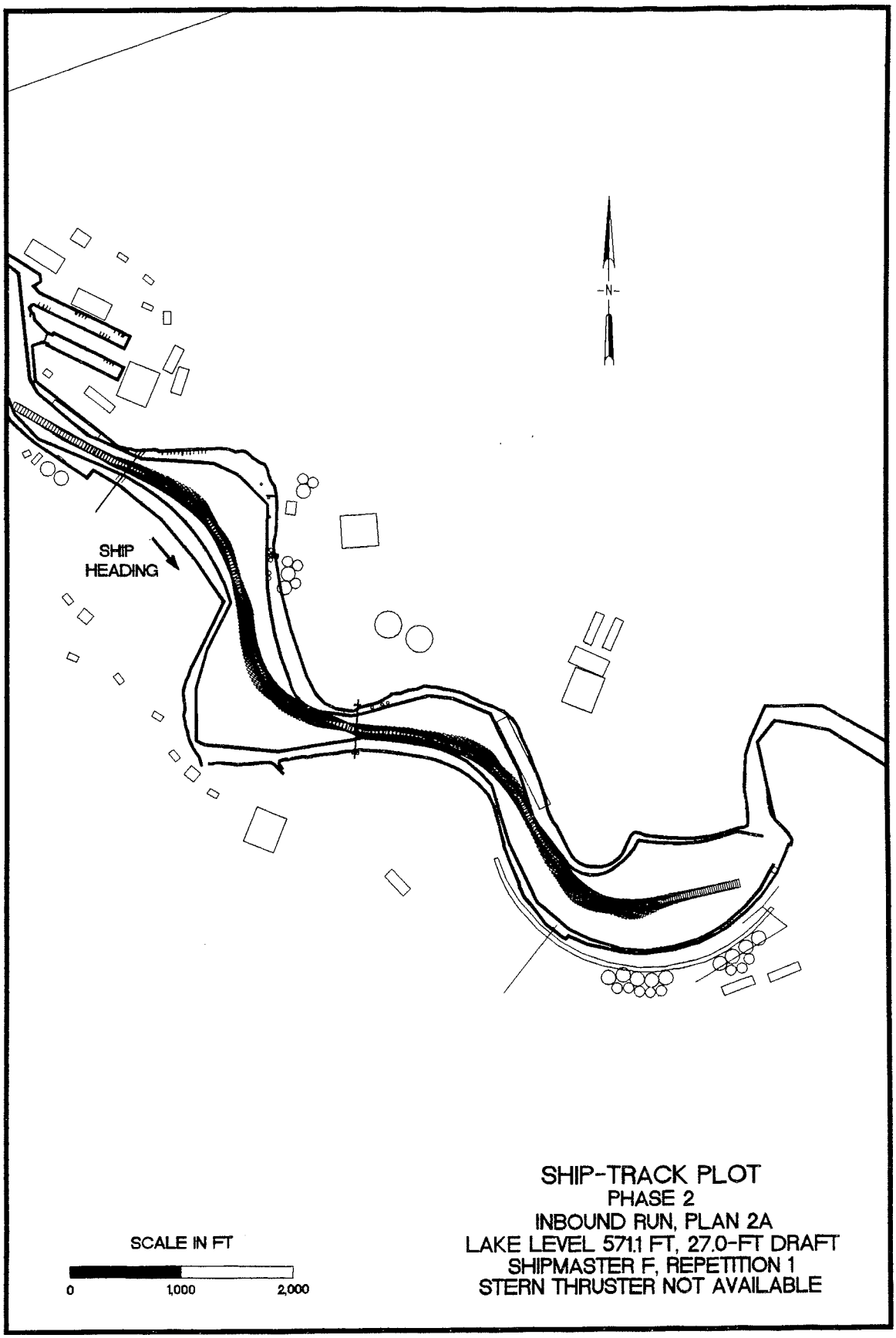
SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 2A
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER F, REPETITION 1
STERN THRUSTER AVAILABLE



SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 2A
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER F, REPETITION 2
STERN THRUSTER AVAILABLE



SHIP-TRACK PLOT
PHASE 2
INBOUND RUN, PLAN 2A
LAKE LEVEL 568.6 FT, 25.5-FT DRAFT
SHIPMASTER F, REPETITION 1
STERN THRUSTER NOT AVAILABLE



SHIP-TRACK PLOT
PHASE 2
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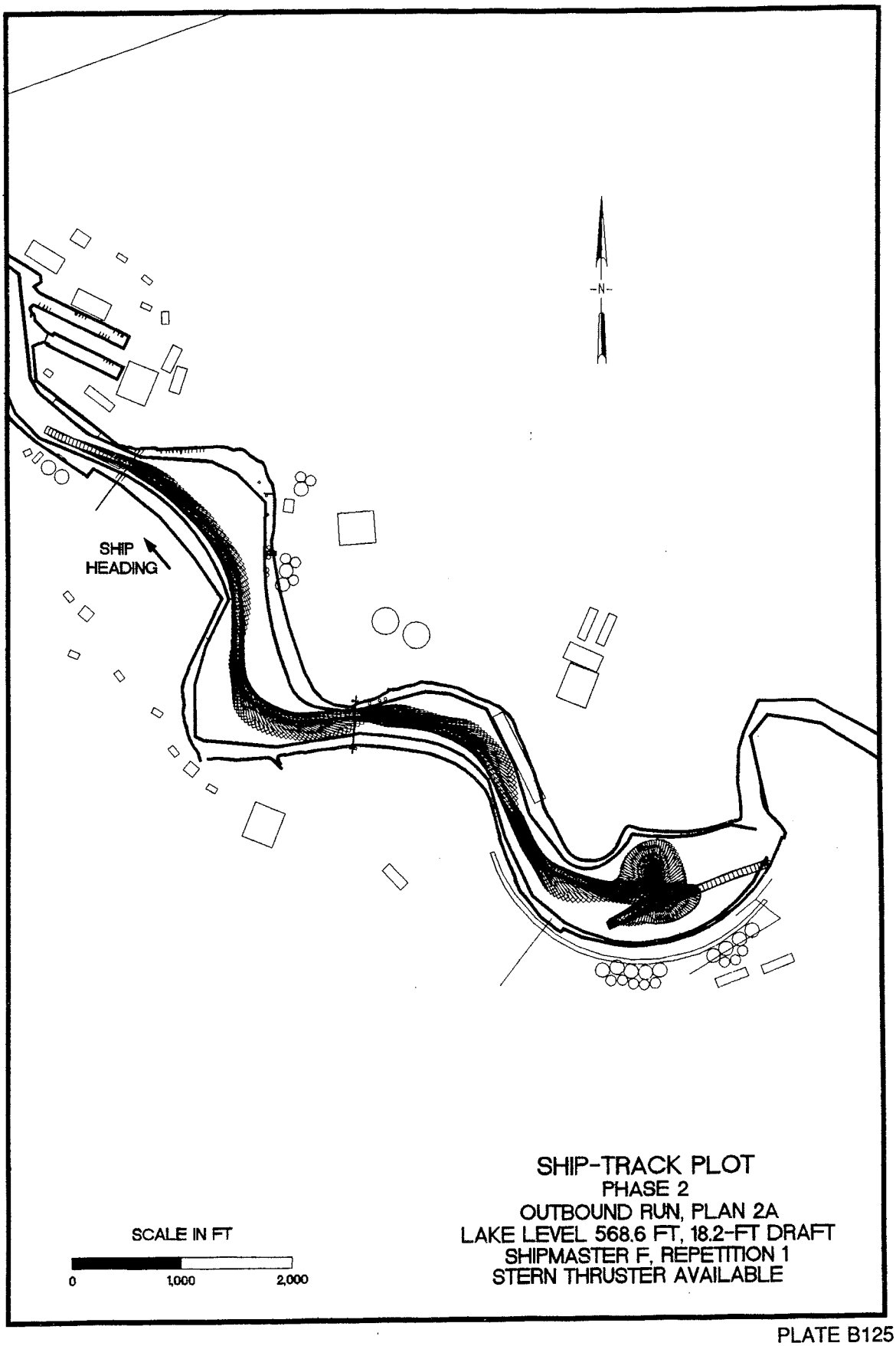
LAKE LEVEL 571.1 FT, 27.0-FT DRAFT
SHIPMASTER F, REPETITION 1
STERN THRUSTER NOT AVAILABLE



SHIP-TRACK PLOT
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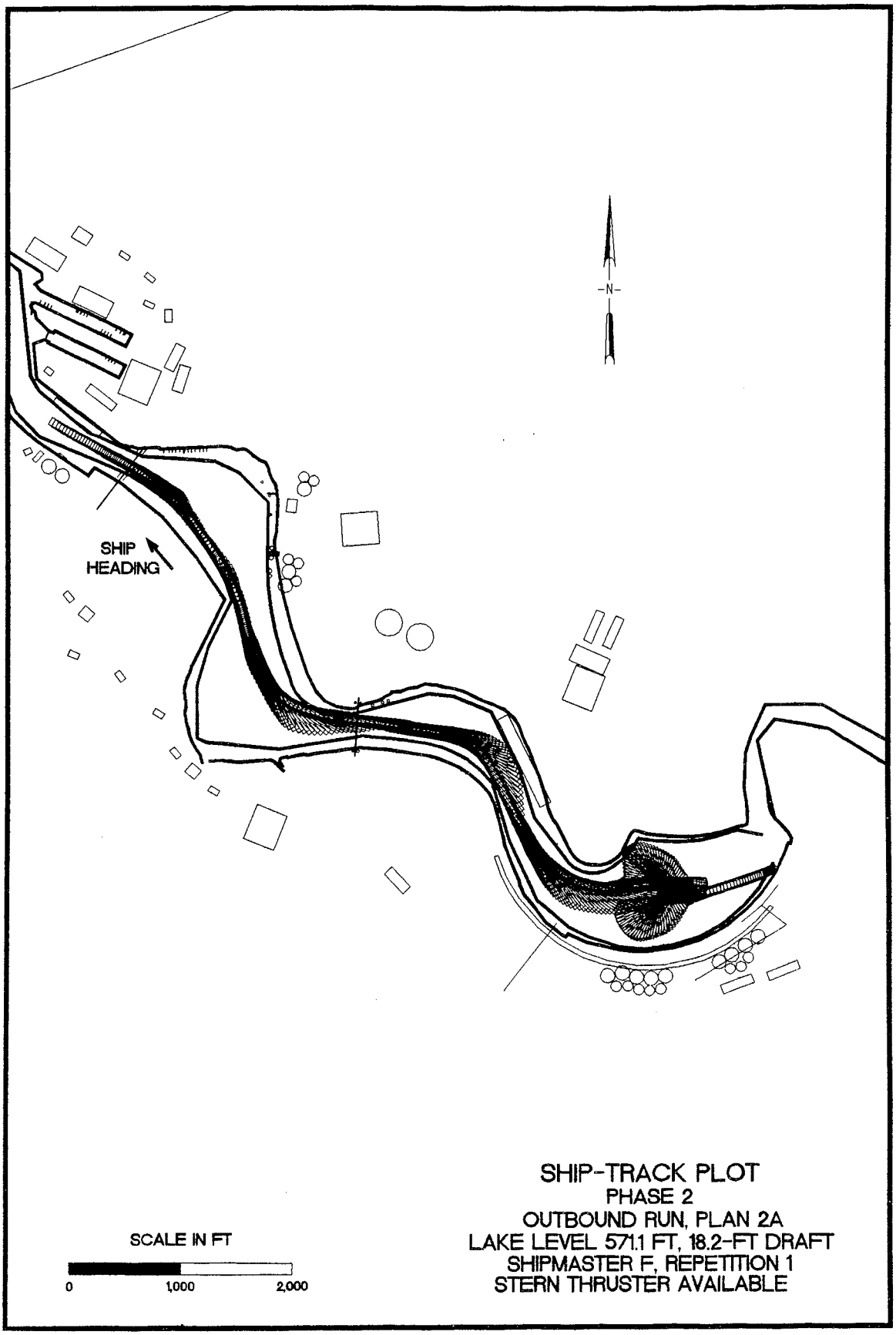
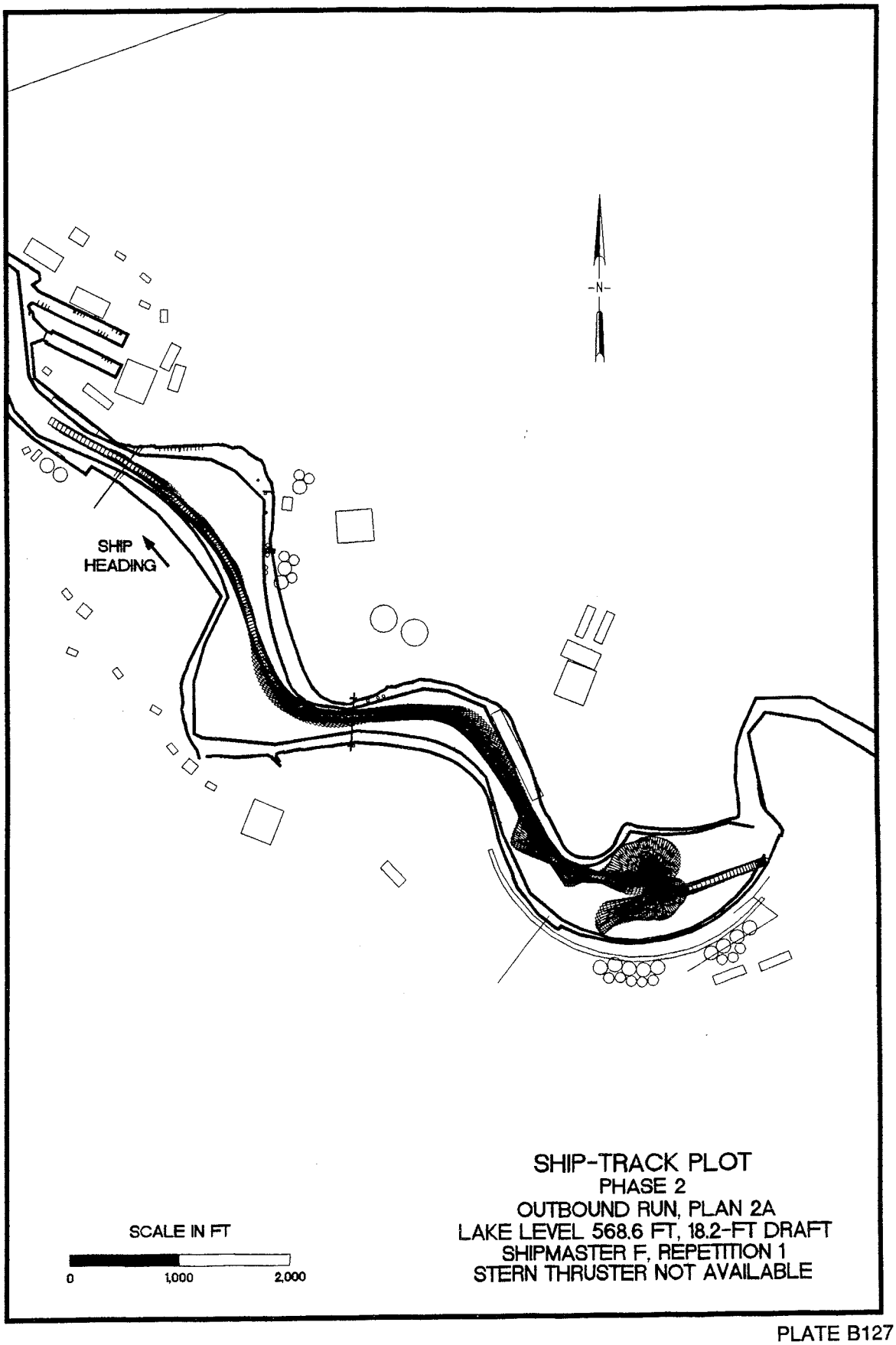
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER F, REPETITION 1
STERN THRUSTER AVAILABLE



SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 2A
LAKE LEVEL 571.1 FT, 18.2-FT DRAFT
SHIPMASTER F, REPETITION 1
STERN THRUSTER AVAILABLE



SHIP-TRACK PLOT
PHASE 2
OUTBOUND RUN, PLAN 2A
LAKE LEVEL 568.6 FT, 18.2-FT DRAFT
SHIPMASTER F, REPETITION 1
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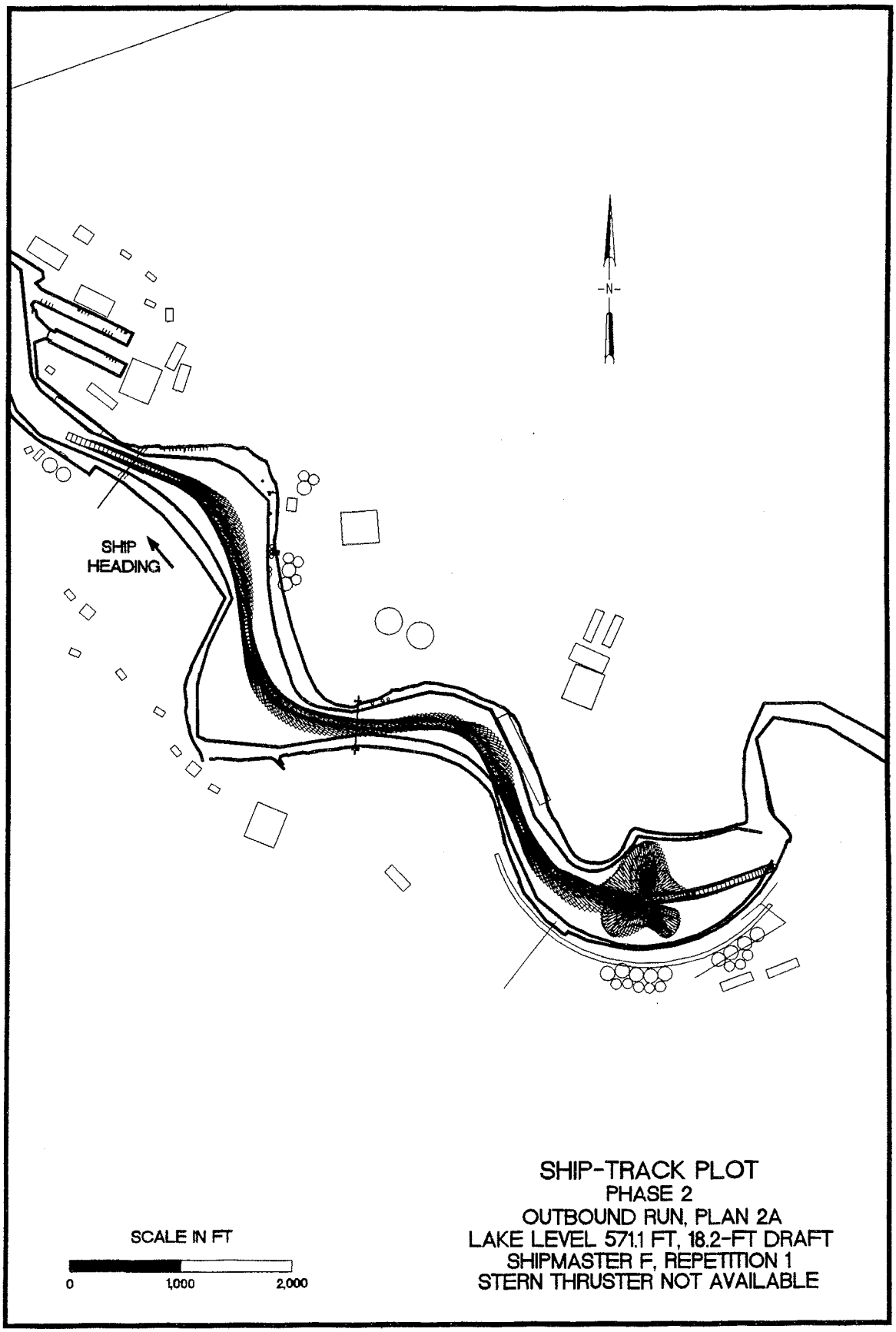

SHIP-TRACK PLOT
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OUTBOUND RUN, PLAN 2A
LAKE LEVEL 571.1 FT, 18.2-FT DRAFT
SHIPMASTER F, REPETITION 1
STERN THRUSTER NOT AVAILABLE

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