Northern Boundary and Transboundary Rivers Restoration & Enhancement Fund

TAKU RIVER FISH WHEELS

Final Report

Prepared by

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INTRODUCTION:

The Taku River is a transboundary river which originates in northern British Columbia and flows southwest through the Coastal Mountain Range and Southeast Alaska to the Pacific Ocean (Figure 1). The Taku River supports numerous stocks of salmon that are harvested by Canadian and U.S. fisheries. The Canadian fishery, that takes place inriver just upriver of the U.S./CDN border, targets Taku River Chinook[1], sockeye and coho salmon and incidentally harvests chum and pink salmon. The U.S. drift gillnet fishery that occurs in Taku Inlet and approach waters, primarily targets Taku River Chinook and sockeye salmon stocks as well as summer chum salmon from local Alaskan enhancement programs during the summer months and mixed stocks of coho salmon in the fall. The U.S. fishery also incidentally harvests chum and pink salmon. The Pacific Salmon Treaty (PST) of 1985, and subsequent additions to the original treaty, established conservation and harvest sharing objectives for the Taku River sockeye Chinook, sockeye, and coho salmon. The most intensive cooperative management is directed at Chinook, sockeye, and coho salmon each having escapement goals of 30,000 to 55,000 large Chinook salmon, 71,000 to 80,000 sockeye salmon, and 35,000 coho salmon.

Inseason fishery management decisions and escapement estimates for the Taku River are based primarily on mark-recapture methods using fish wheels as the primary capture (Table 1) and tagging site, and inriver test and Canadian gillnet fisheries for recapture. The fish wheels are located at Canyon Island in the lower Taku River just downriver of the U.S./CDN border (Figure 1). These fish wheels are used to capture Chinook, sockeye, and coho salmon for tagging and typically are operational by mid-May and continue to operate through the end of September. This time frame encapsulates all salmon migration periods in the Taku River. The fish wheels also catch pink and chum salmon and the occasional trout. Although abundance is not estimated for pink and chum salmon, the catches do provide an index of interannual variation. This is especially valuable if the entire migration period is bracketed by the period of fish wheel. Age, sex, and length data are also collected from all species caught in the fish wheels.

Over time the fish wheels require repair and improvements. It is normal through one season to replace several arms, ribs, and nubs that crack due to regular wear and tear. The last three seasons have had atypical high water levels that cause the fish wheels to spin at excessive rates that exacerbate wear and tear. In order to keep the wheel "balanced", similar to a car tire, a complete fish wheel replacement was deemed necessary. Therefore, funding was secured from the Northern Fund to replace one entire fish wheel and replace and repair the other fish wheel.

FISH WHEEL CONSTRUCTION:

Plans for the new fish wheel and repair work were delivered to Paul Simpco of Simpco Welding located in Juneau in the fall of 2007. The complete rebuild was finished during the winter and available for transport in the spring of 2008. The smaller wheel parts were loaded onto Ward Air Otter flights for transport to Canyon Island. The larger arms and ribs were transported using helicopters and slings. All of the fish wheels items were transported by the end of April 2008. A

[1] New directed Chinook fisheries have been implemented as a result of an agreement reached between Canada and the U.S. in February 2005.

Table 1.-Canyon Island fish wheel salmon catches and periods of operation on the Taku River, 1983-2008.

Year	Period of Operation	Catch				
		Chinook	Sockeye	Coho	Pink	Chum
1984	6/15-9/18	138	2,334	889	20,751	316
1985	6/16-9/21	184	3,601	1,207	27,670	1,376
1986	6/14-8/25	571	5,808	758	7,256	80
1987	6/15-9/20	285	4,307	2,240	42,786	1,533
1988	5/11-9/19	1,436	3,292	2,168	3,982	1,089
1989	5/05-10/01	1,811	5,650	2,243	31,189	645
1990	5/03-9/23	1,972	6,091	1,860	13,358	748
1991	6/08-10/15	680	5,102	4,922	23,553	1,063
1992	6/20-9/24	212	6,279	2,103	9,252	189
1993	6/12-9/29	562	8,975	2,552	1,625	345
1994	6/10-9/21	906	6,485	4,792	27,100	367
1995	5/4-9/27	1,535	6,228	2,535	1,712	218
1996	5/3-9/20	1,904	5,919	1,895	21,583	388
1997	5/3-10/1	1,321	5,708	1,665	4,962	485
1998	5/2-9/15	894	4,230	1,777	23,347	179
1999	5/3-10/3	440	4,636	1,848	23,503	164
2000	4/23-10/3	1,211	5,865	1,877	6,529	423
2001	4/23-10/5	1,262	6,201	2,380	9,134	250
2002	4/24-10/7	1,578	5,812	3,766	5,672	205
2003	4/20-10/08	1,351	5,970	3,002	15,492	268
2004	4/30-10/06	2,234	6,255	3,163	8,464	414
2005	4/25-10/05	517	3,953	1,476	15,839	258
2006	4/27-10/03	544	5,296	2,811	21,725	466
2007	4/27-10/3	430	7,673	2,117	12,405	482
2008	5/18-10/03	1,243	3,459	2,021	4,704	350

crew of five technicians, two personnel each from the Alaska Department of Fish and Game (ADF&G) and the Department of Fisheries and Oceans Canada (DFO) and one member from the Taku River Tlingit First Nations (TRTFN) then assembled both wheels and moved them into the water by late May.

Each new fish wheel consisted of two aluminum pontoons in a framework, measuring approximately 12 m in length and 6 m in width and filled with closed-cell Styrofoam for floatation, supporting an axle, paddle, and basket assembly. Two fish-catching baskets were rotated about the axle by the force of the water current against the baskets and/or paddles. As the fish wheel baskets rotated, they scooped up salmon from the river. Slides attached to the rib structure of each basket directed fish to aluminum liveboxes bolted to the outer sides of the pontoons.

The new fish wheels were positioned in the vicinity of Canyon Island on opposite riverbanks, approximately 200 m apart, and have been operated in identical locations since 1984. They were secured in position by anchoring to large trees with 0.95 cm steel cable and were held out from, and parallel to, the shoreline by log booms. The Taku River channel at this location is ideal for fish wheel operation as the river is fully channelized through a relatively narrow canyon that has very steep walls. The diagrams used in construction are detailed in Appendix A.

MEASURES OF SUCCESS:

All of the fish wheel parts were on site by the end of April 2008. Due to low water levels, the fish wheels could not be placed in the river until late May; nevertheless, this was ahead of schedule and the due to late run timing of the Chinook salmon run, most fish were sampled using fish wheels in 2008. The performance of the fish wheels can not be judged by sheer numbers of fish caught (Table 1) due to inter annual variation in salmon run sizes. The best measure of improvement is simply through hours of operation. In 2008, the fish wheels were operational (i.e., in the water spinning) longer than in any other prior year. Although the water levels were favorable for fish

wheel operation in 2008, most of the success is a direct result of the new fish wheel design and repairs that resulted in few incidents of breakdown.

Estimates of Chinook, sockeye, and coho salmon run size were made using information gathered in part through fish wheel operation near Canyon Island in 2008. This season the Chinook salmon run was noticeably late in run timing, in the neighborhood of a couple of weeks at start and about average near the end of the run. The preliminary total inriver run estimate for Taku River Chinook salmon in 2008 is about 24,000 large fish, a below average run. The sockeye salmon run also appeared to be late in run timing yet it too finished up with what was considered on-time run timing. This year the preliminary estimated total inriver run estimate for Taku River sockeye salmon is about 120,000, slightly below average. The coho salmon run was unique when compared to the Chinook and sockeye salmon runs in that run timing was at least one week early at the start. The preliminary total inriver run estimate for Taku River coho salmon in 2008 is about 90,000 fish.

CONCLUSION:

The construction of the new fish wheel and repairs and maintenance to the other fish wheel resulted in immediate beneficial results to the cooperative stock assessment project. Time and money was saved by a substantial decrease in the typical number of breakdowns and mishaps that occur on a seasonal basis. In addition, the improvements also expedite the construction, installation, and deconstruction necessary each year. Although over $50,000 U.S. was provided for this work, it is anticipated these costs alone will be saved in just a few short years due to improved fish wheel efficiencies. These efficiencies will also directly benefit the Chinook, sockeye, and coho salmon stock assessment projects through more stable fish wheel operation times and catchability rates.

ACKNOWLEDGMENT:

We would like to thank Mike Lafollette, Ben Hermans, and Jerry Owens of ADF&G; Kirstie Falkevitch and Lars Jessup of DFO; and Mike Smarch of TRTFN for their help with on-site construction of the fish wheels. We additionally thank Mike Lafollette and Paul Simpco of Simpco Welding for their time and effort in the improved fish wheel design and Mr. Simpco for his expertise in aluminum engineering, welding, and construction. We thank Ward Air, Coastal Helicopters Inc., and River Dirtbags Barge Service for their diligence in delivery of the fish wheel parts and pieces.

DETAILED BUDGET SUMMARY:

In total, the Northern Fund provided $56,750 U.S. funds for the Taku River Fish Wheel project. Of that, 10% or $5,675 was held back by the Northern Fund pending the completion of a final report resulting in ADF&G receiving $51,075. Thirty-four line item expenditures were made by ADF&G from June 19, 2007 to June 18, 2008 totaling $49,853 for work on the Taku River Fish Wheels project (Table 2).

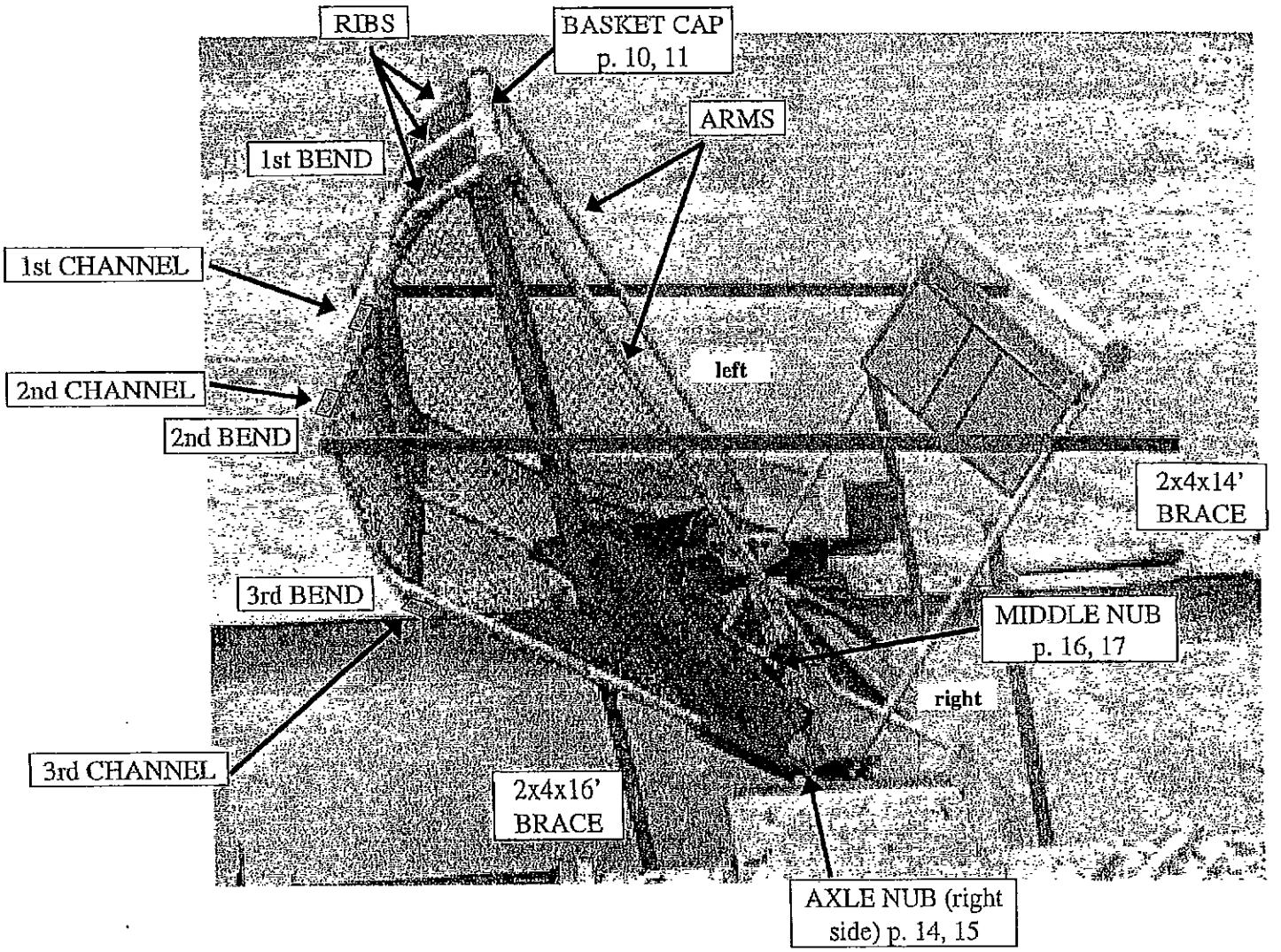
The bulk of the costs associated with this project totaling $32,246 were associated with welding and aluminum engineering performed by Simpco Welding and T&S Welding in Juneau. Transportation of the materials from Juneau to Canyon Island was the next most costly item associated with this work totaling $7,944 among three vendors (i.e., Ward Air, Coastal Helicopters Inc., and River Dirtbags Barge Service (Table 2).

Table 2.-Line item expenditures by date and vendor for all purchases made for the Taku River Fish Wheels project from June 19, 2007 to June 18, 2008.

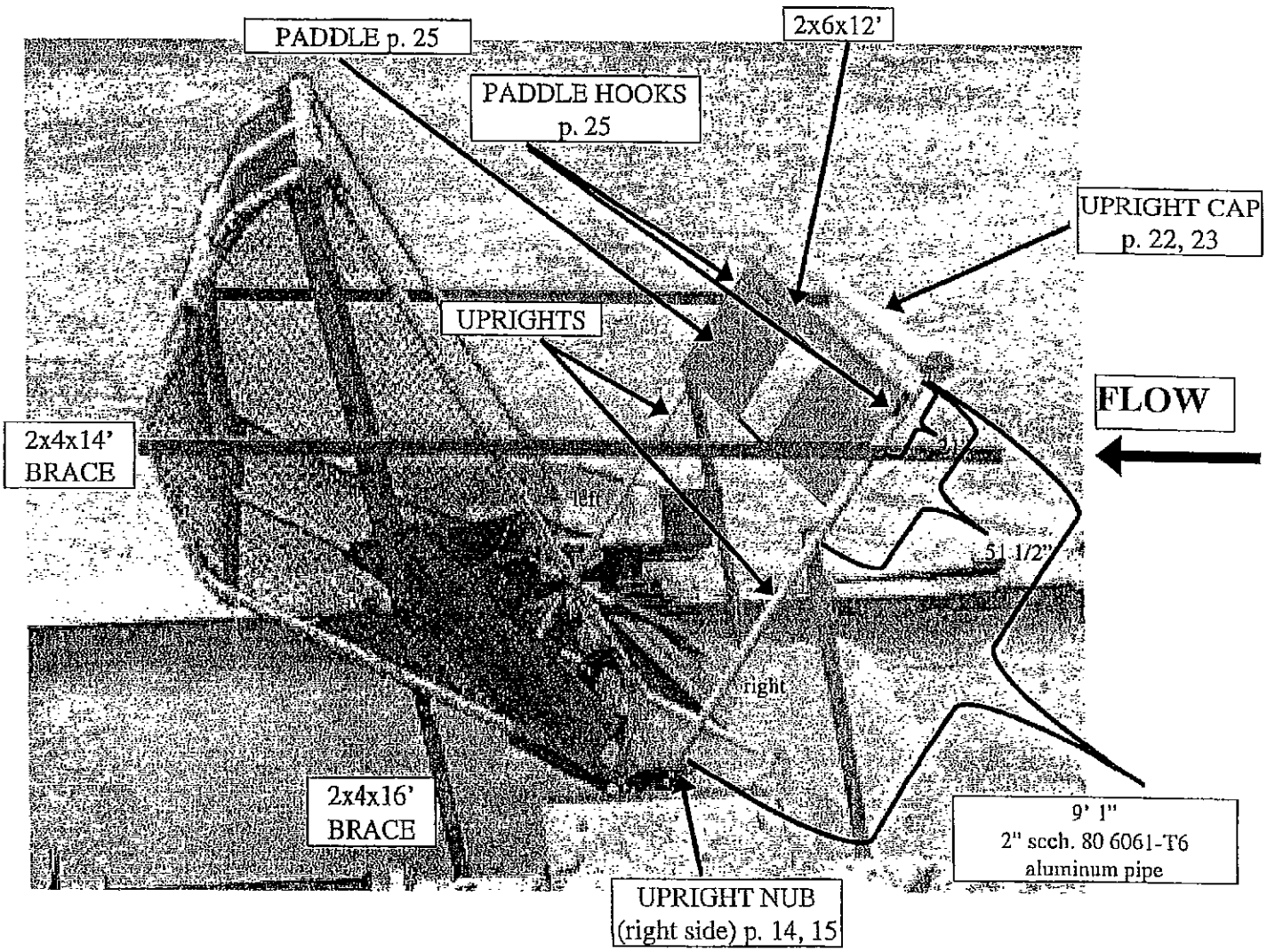
Date	Vendor	Description	Amount
06/19/07	KATHRYN LEE HANSEN	Labortory supplies	$220.17
06/27/07	DON ABEL BUILDING SUPPLY	Parts and supplies	$366.78
06/27/07	ALASKA INDUSTRIAL HARDWARE	Parts and supplies	$76.74
07/01/07	RIVER DIRTBAGS BARGE SERVICE	Marine freight	$1,294.58
07/06/07	HARBOR ENTERPRISES	Marine fuel	$136.95
07/10/07	HARBOR ENTERPRISES	Marine fuel	$1,743.41
07/12/07	RIVER DIRTBAGS BARGE SERVICE	Marine freight	$1,337.45
07/12/07	VALLEY LUMBER & BUILDING	Nails/lumber	$1,778.10
07/19/07	T&S WELDING	Welding	$954.30
07/19/07	HOME DEPOT	Hardware	$146.77
07/19/07	OUTDOOR HEADQUARTERS	Pump	$14.47
07/19/07	HOME DEPOT	PVC pipe	$3.84
07/20/07	TANNER'S SERVICE CENTER	Marine repair	$756.10
07/21/07	RIVER DIRTBAGS BARGE SERVICE	Marine freight	$651.34
02/06/08	SIMPCO SIMPSON & SON	Fish wheel parts - welding	$28,446.16
04/02/08	TANNER'S SERVICE CENTER	Outboard motor service	$422.49
04/16/08	VALLEY LUMBER & BUILDING	Hardware	$72.60
04/21/08	SIMPCO WELDING	Parts and supplies	$1,090.00
04/23/08	COASTAL HELICOPTERS INC	Helicopter - Astar JNU CYI sling load	$1,729.30
04/24/08	ALASKA INDUSTRIAL HARDWARE	Parts and supplies	$28.07
04/24/08	ALASKA INDUSTRIAL HARDWARE	Galvanized pipe 1/2" x 5" NC GR2	$83.83
04/29/08	ALASKA INDUSTRIAL HARDWARE	Gloves	$29.01
05/01/08	C&M MACHINE	Drill shop time and materials	$560.08
05/05/08	VALLEY LUMBER & BUILDING	Lumber	$90.75
05/14/08	SIMPCO WELDING	Fish wheel parts - welding	$1,756.00
05/14/08	ALASKA INDUSTRIAL HARDWARE	Hardware - washers	$4.28
05/15/08	WARD AIR	Float plane - Beaver JNU CYI	$572.67
05/23/08	WARD AIR	Float plane - Beaver JNU CYI	$625.00
06/03/08	WARD AIR	Float plane - Beaver JNU CYI	$637.50
06/05/08	WARD AIR	Float plane - Beaver JNU CYI	$637.50
06/16/08	HARBOR ENTERPRISES	Heating oil	$946.96
06/16/08	WARD AIR	Float plane - 206 JNU CYI	$459.00
06/16/08	HARBOR ENTERPRISES	Marine fuel	$1,624.04
06/18/08	DON ABEL BUILDING SUPPLY	Lumber	$557.03
		Sub total	$49,853.27
	Indirect costs @ 13.5%		$6,730.19
		Total	$56,583.46

Appendix A.-Diagrams and detailed engineering specifications used for construction and maintenance of fish wheels operated near Canyon Island in the lower Taku River in 2008.

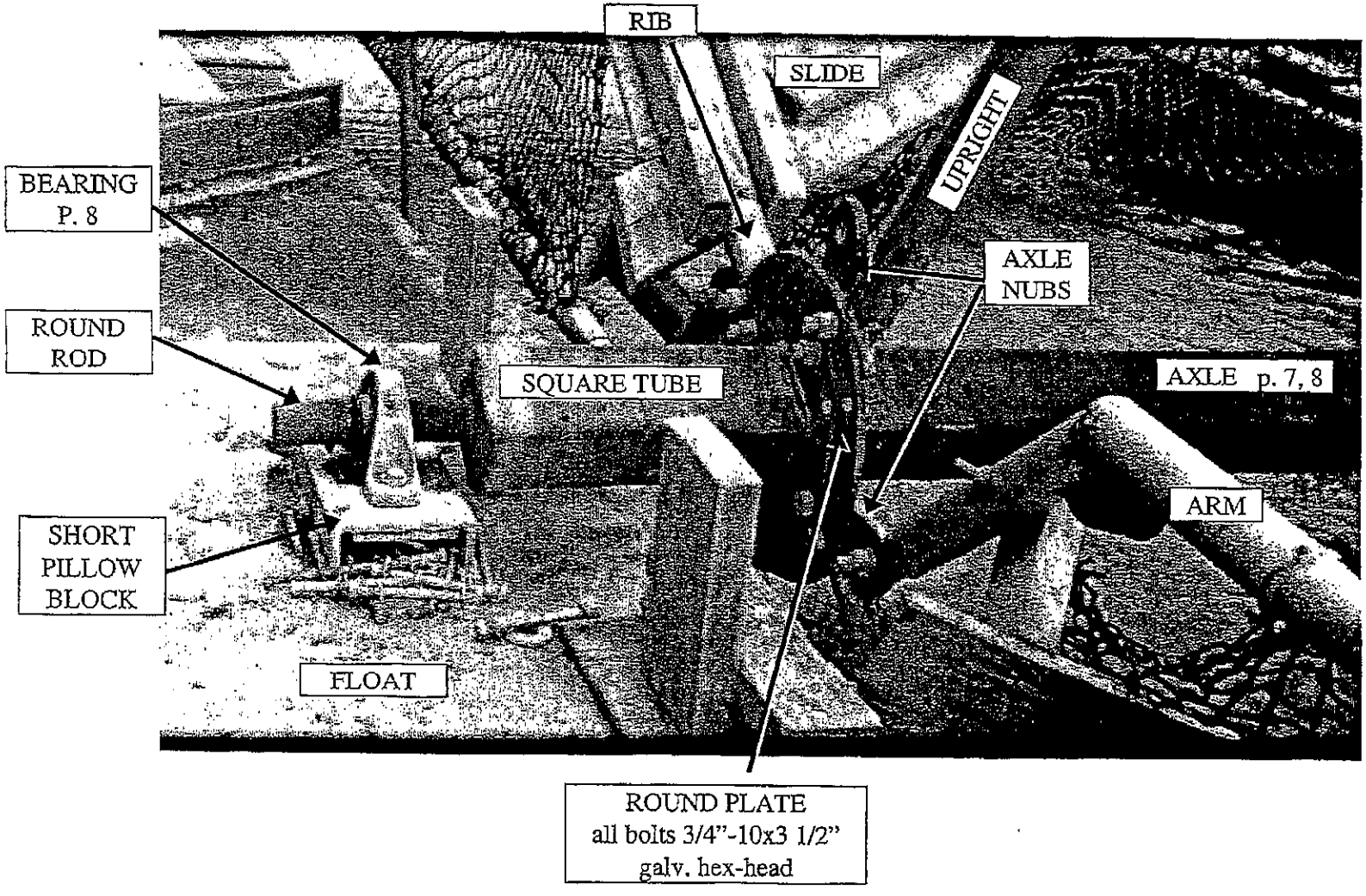
BASKET DETAILS



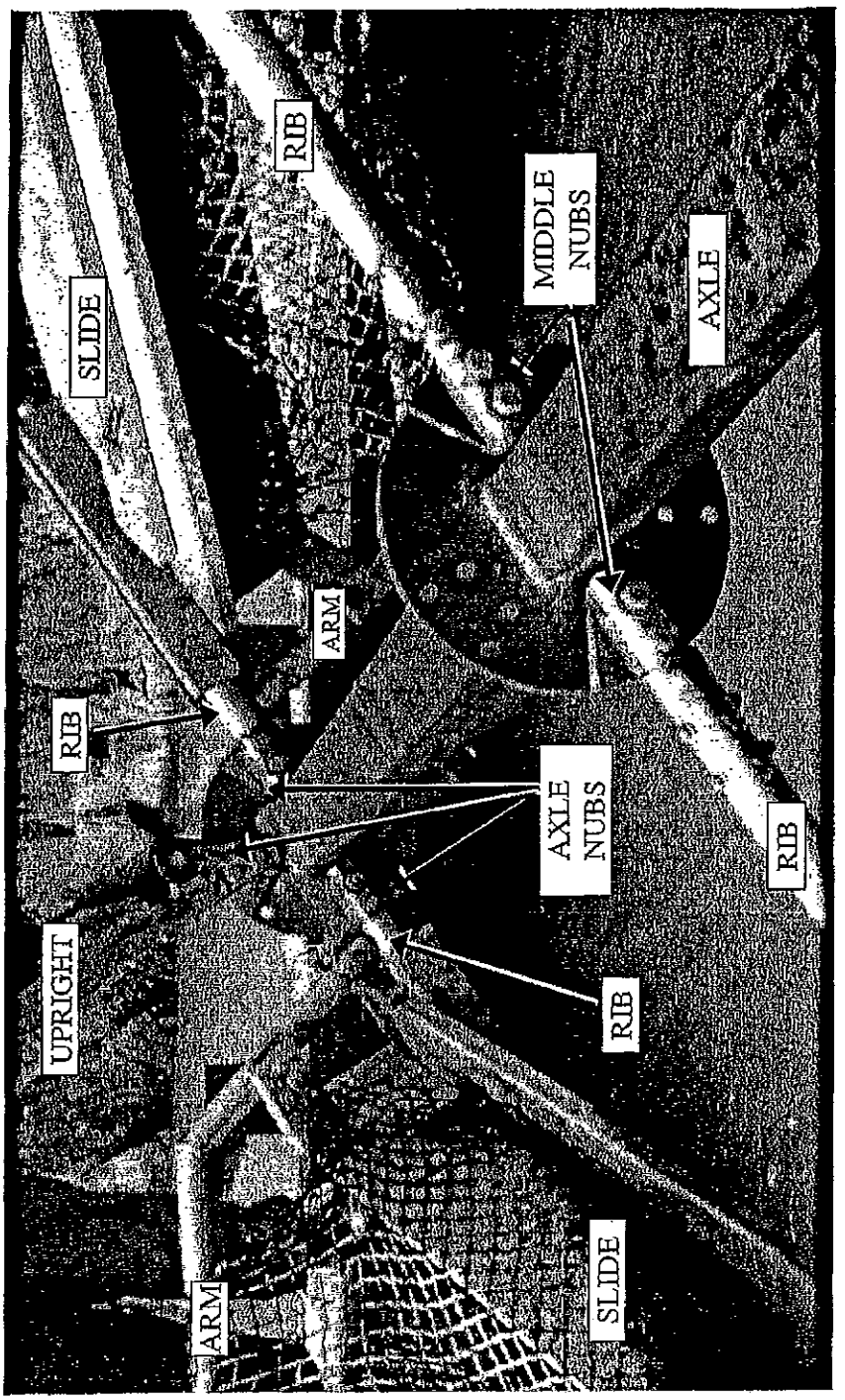
UPRIGHT DETAILS



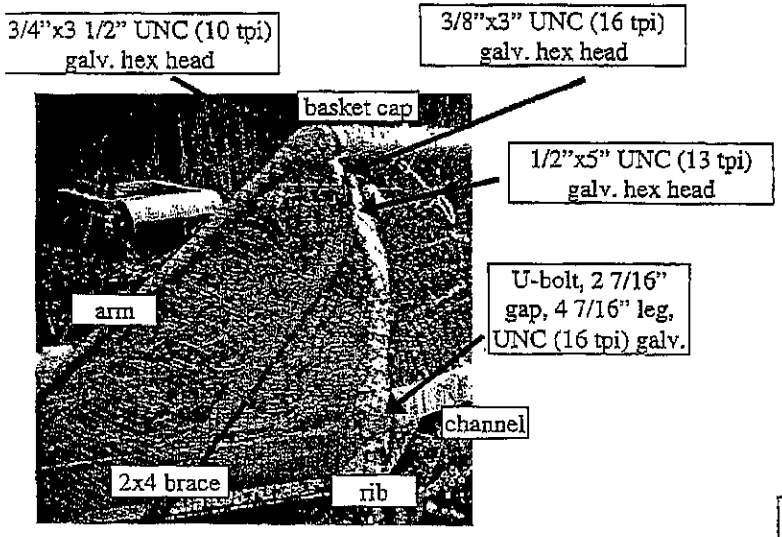
BEARING DETAILS

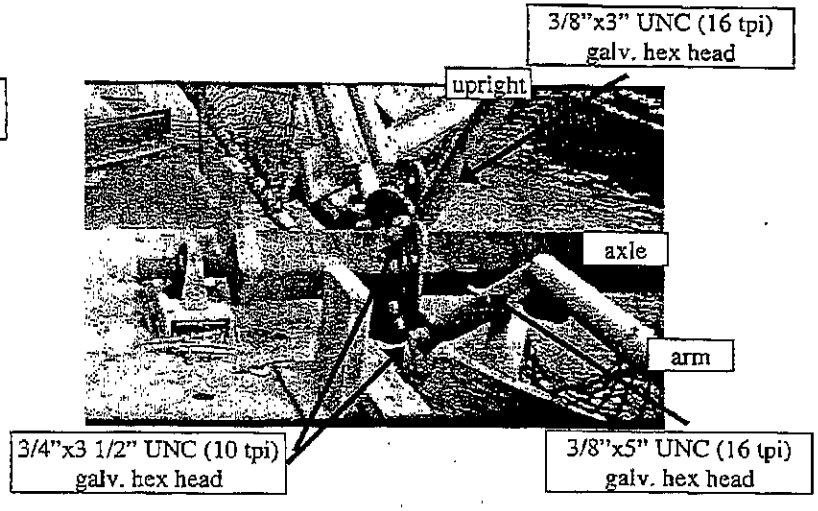


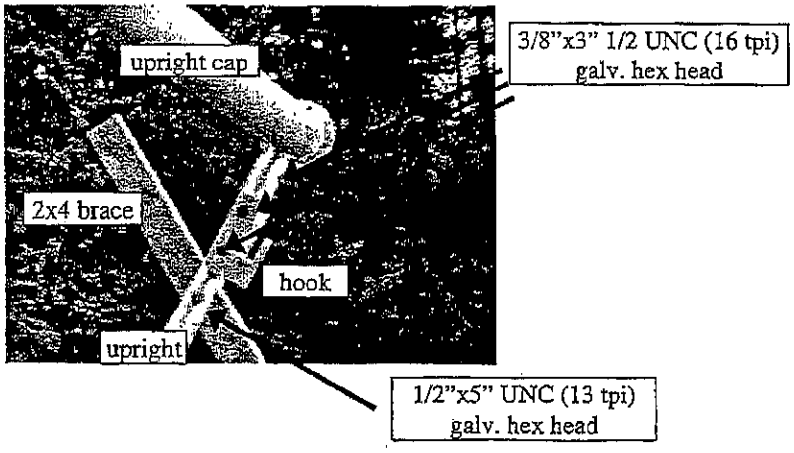
NUB DETAILS


UPRIGHT
SLIDE
RIB
ARM
RIB
ARM
AXLE
NUBS
RIB
SLIDE
RIB
MIDDLE
NUBS
AXLE
RIB

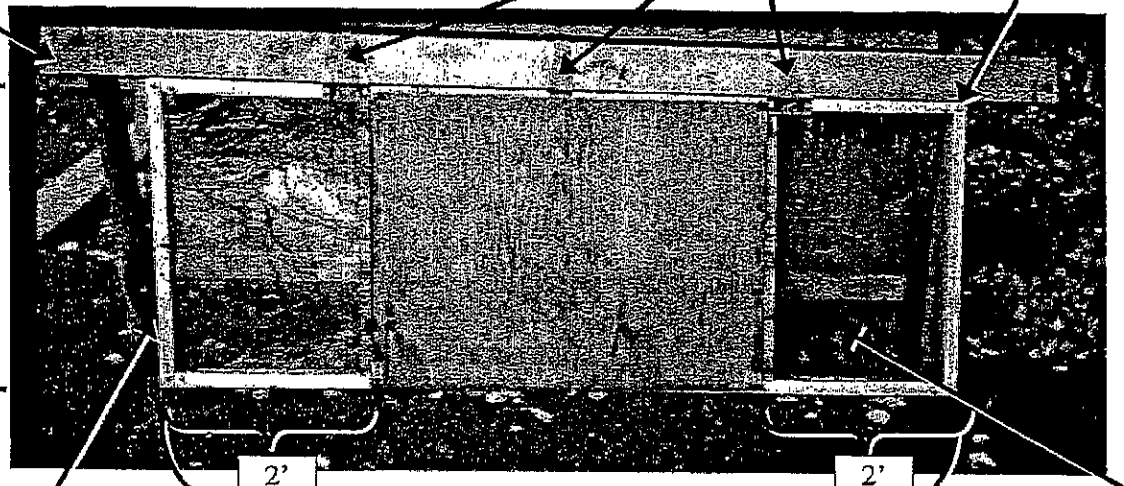
BOLT SIZES


3/4"x3 1/2" UNC (10 tpi) galv. hex head
3/8"x3" UNC (16 tpi) galv. hex head
basket cap
1/2"x5" UNC (13 tpi) galv. hex head
U-bolt, 2 7/16" gap, 4 7/16" leg, UNC (16 tpi) galv.
arm
channel
2x4 brace
rib

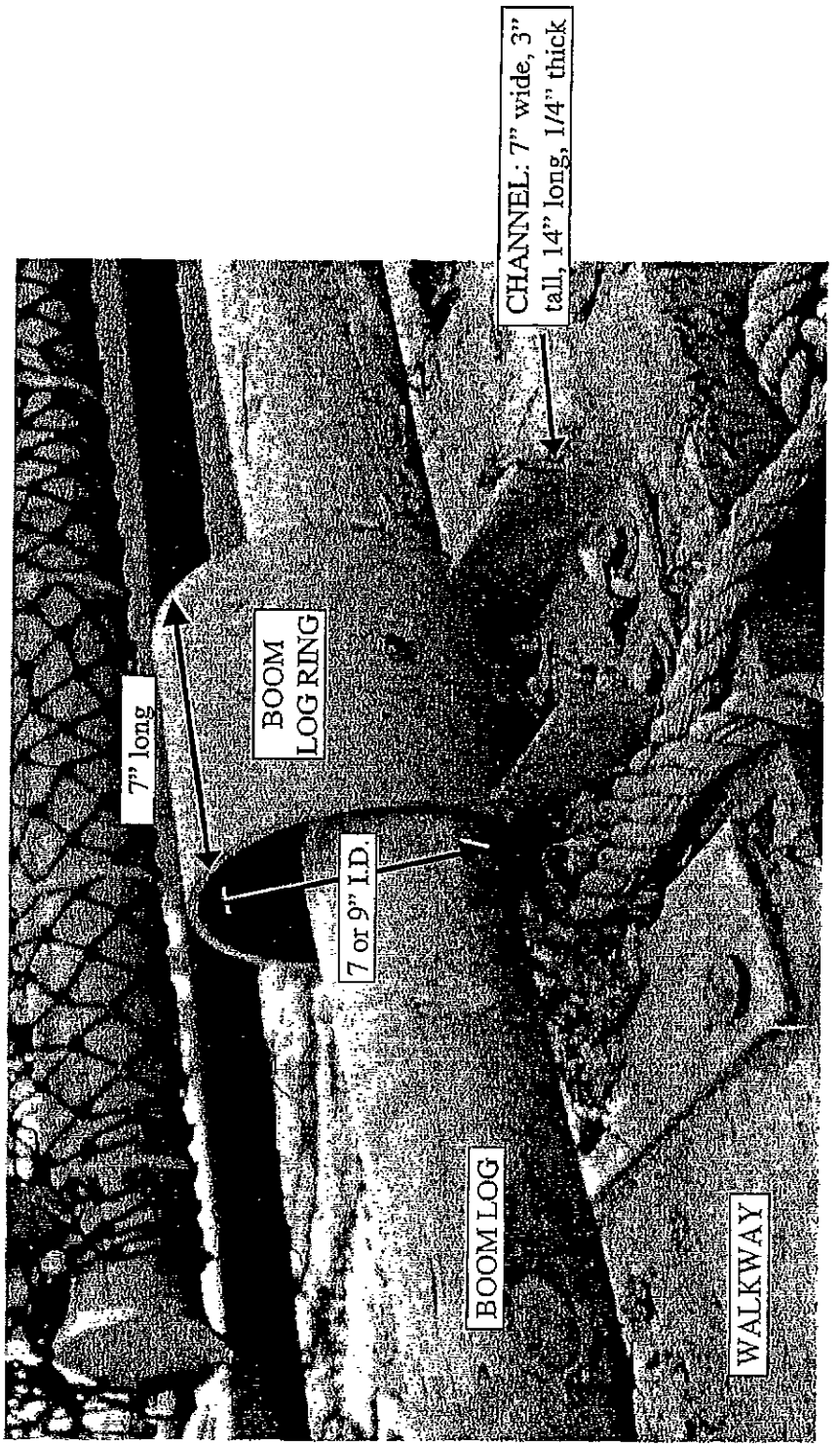

3/8"x3" UNC (16 tpi) galv. hex head
upright
axle
arm
3/4"x3 1/2" UNC (10 tpi) galv. hex head
3/8"x5" UNC (16 tpi) galv. hex head


upright cap
3/8"x3" 1/2 UNC (16 tpi) galv. hex head
2x4 brace
hook
upright
1/2"x5" UNC (13 tpi) galv. hex head

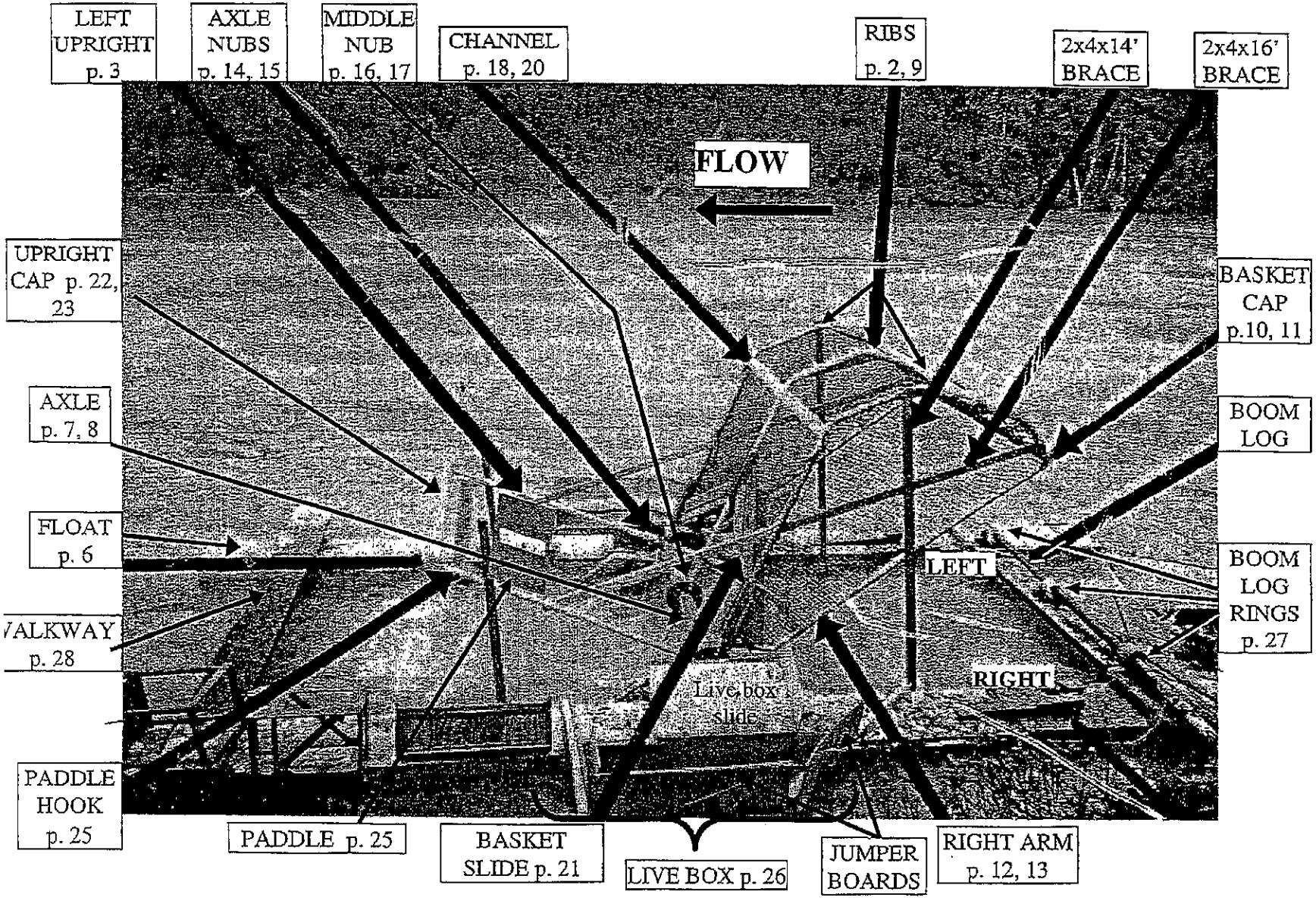
PADDLE


Hinges: 7" on long side, 2" on short side, 5 1/2" wide
3/8x3" UNC bolts, 16 tpi, galv. hex head
2x6x12'
24" or 36" hi
2'
2'
8'
FRAME: 1 1/4" legs x 1/4" thick Al angle
Tuffak ® polycarbonate sheet, 3/16" thick

BOOM LOG RING DETAILS

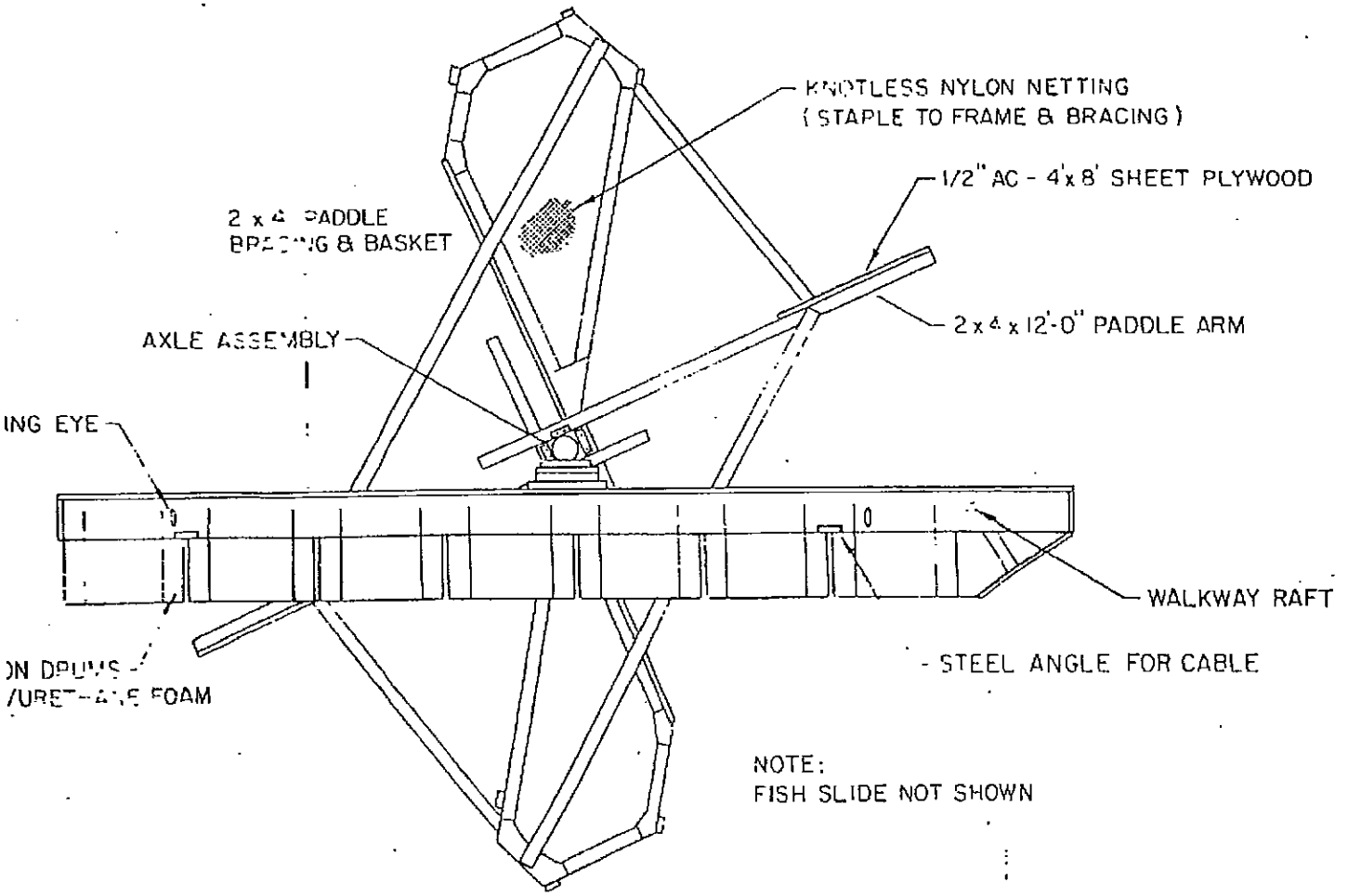


OVERALL VIEW

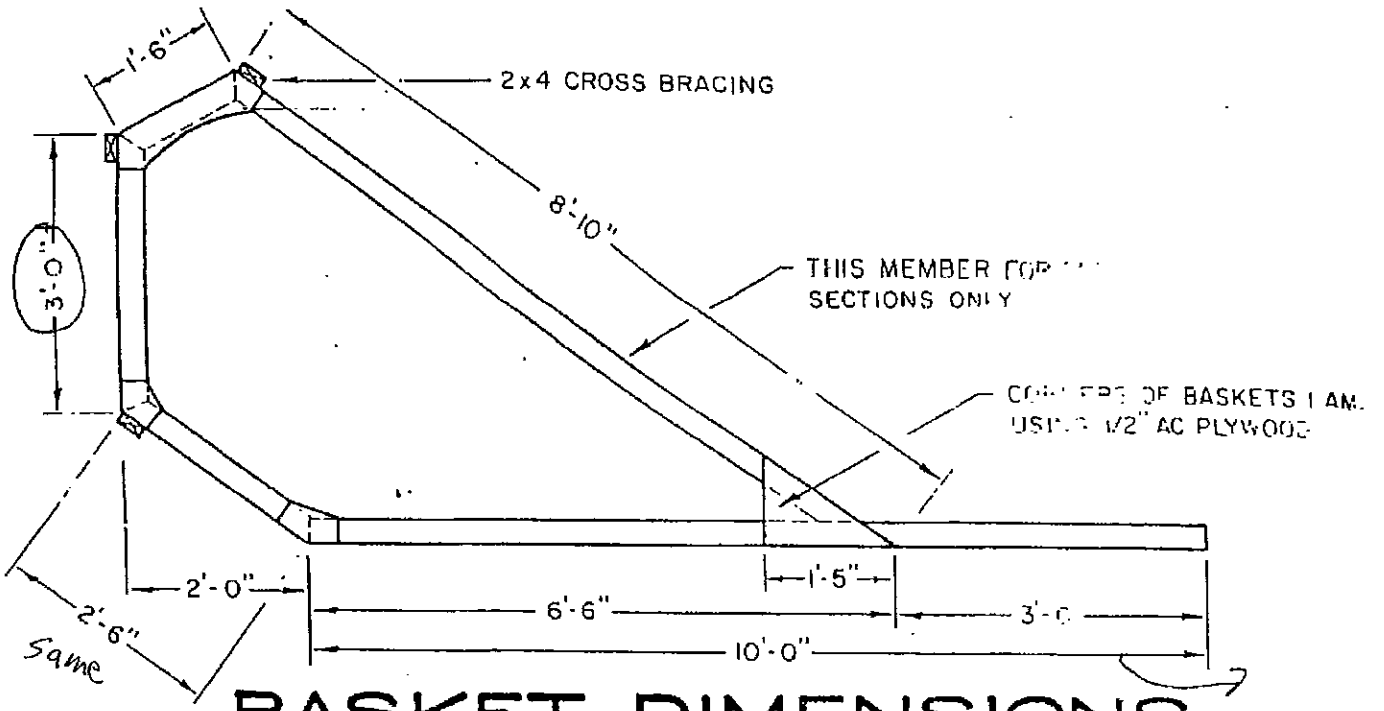


FISHWHEEL - PLAN VIEW

SCALE: 3/8" = 1'-0"

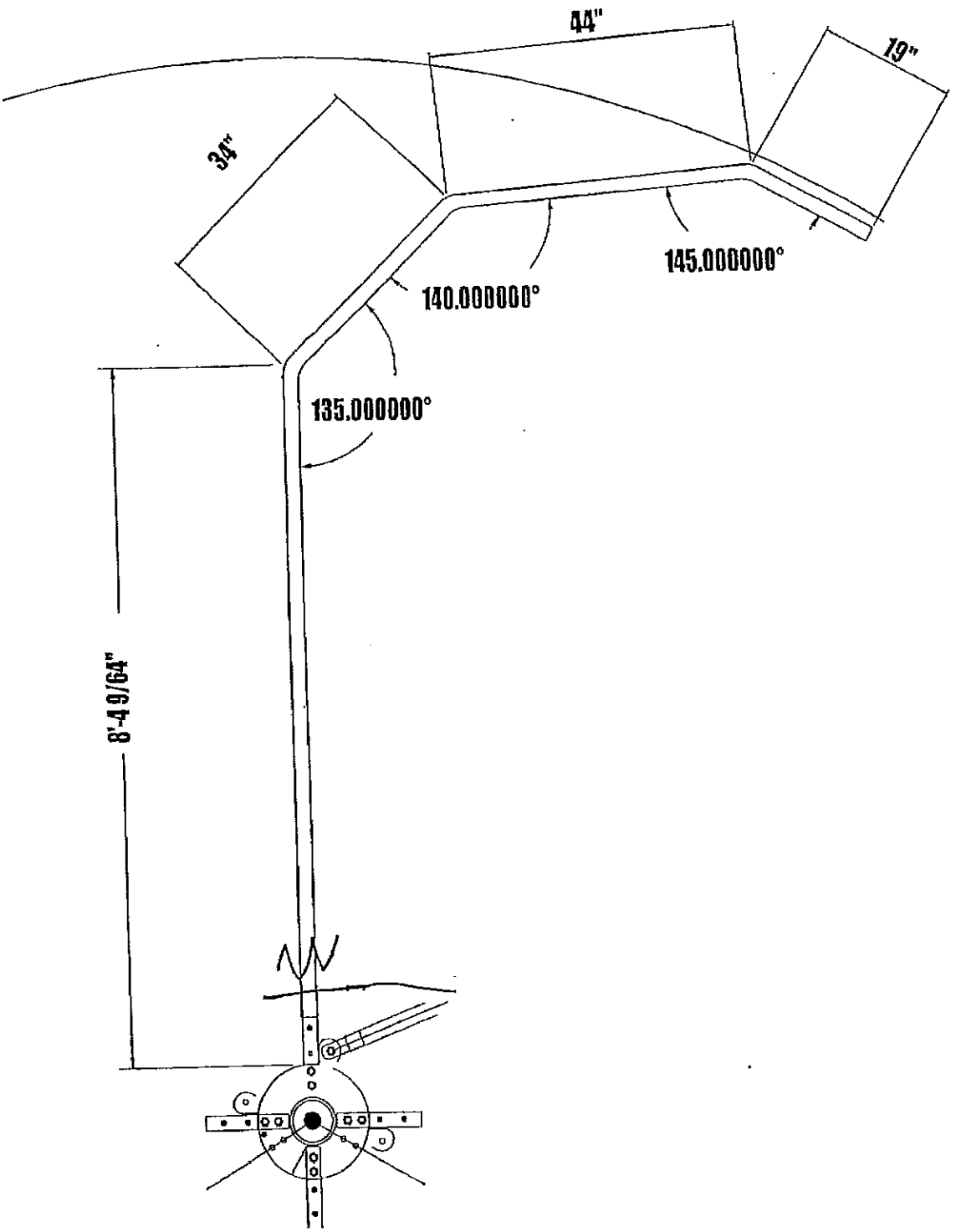


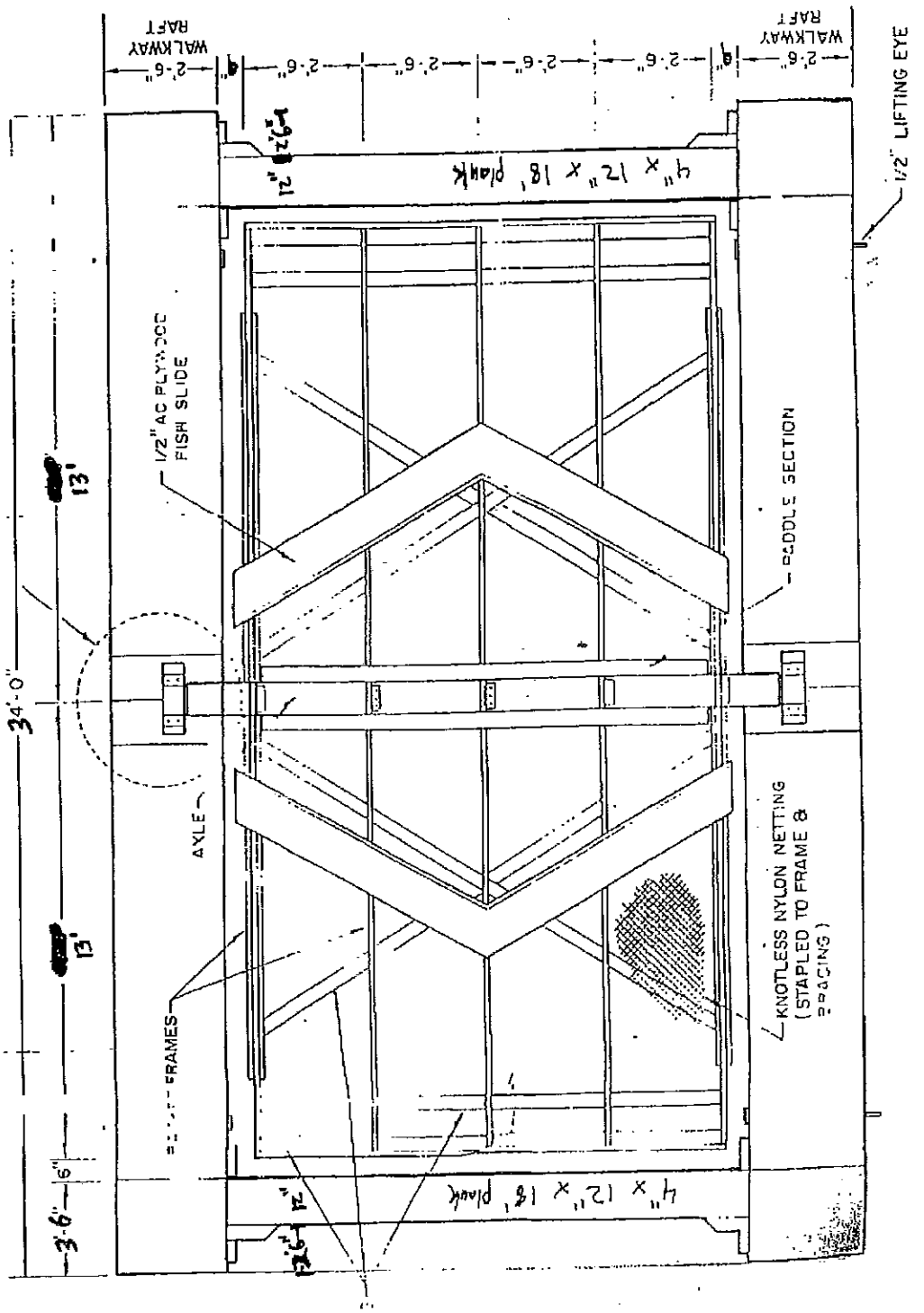
- SIDE ELEVATION -



BASKET DIMENSIONS

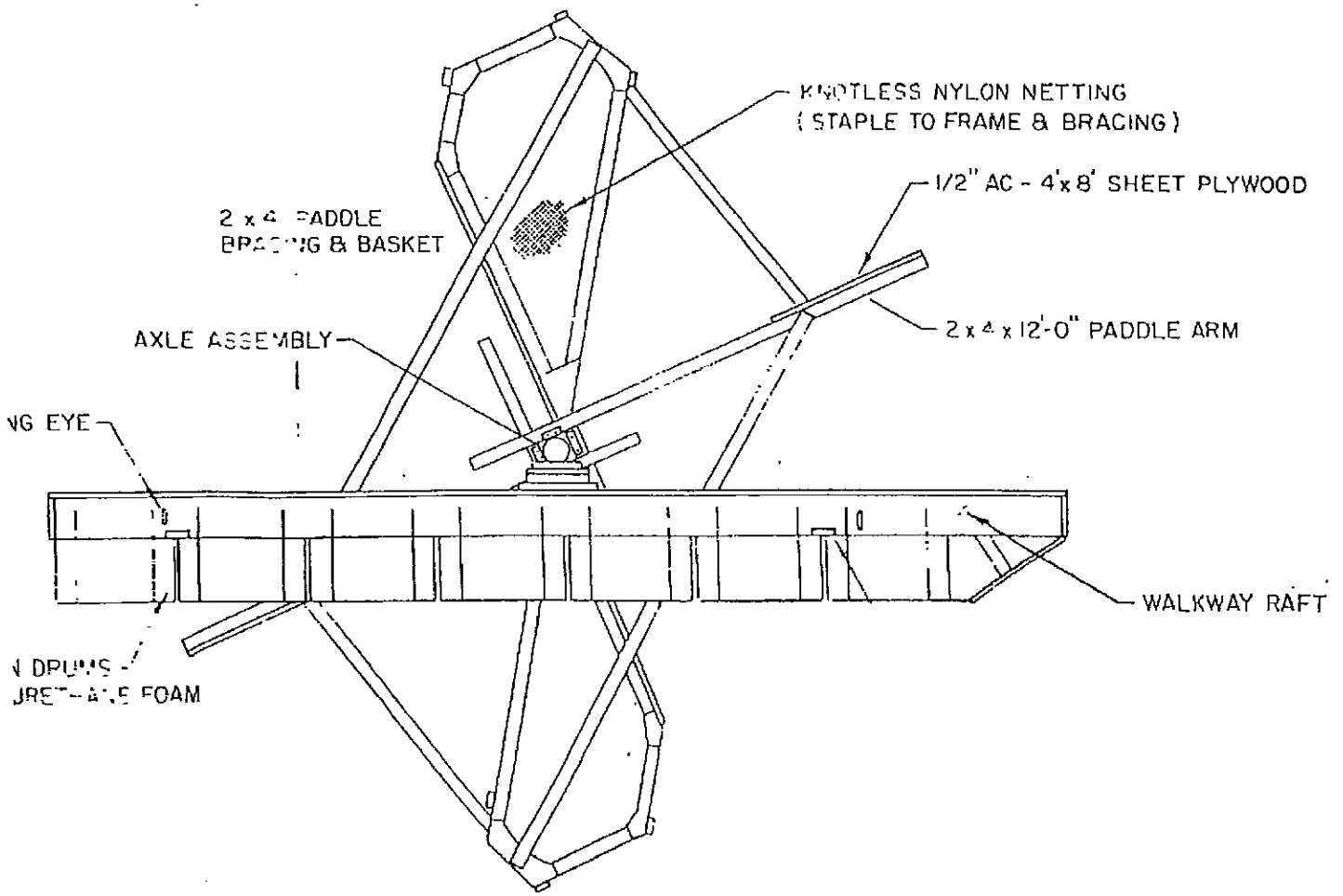
SCALE: 1/2" = 1'-0"

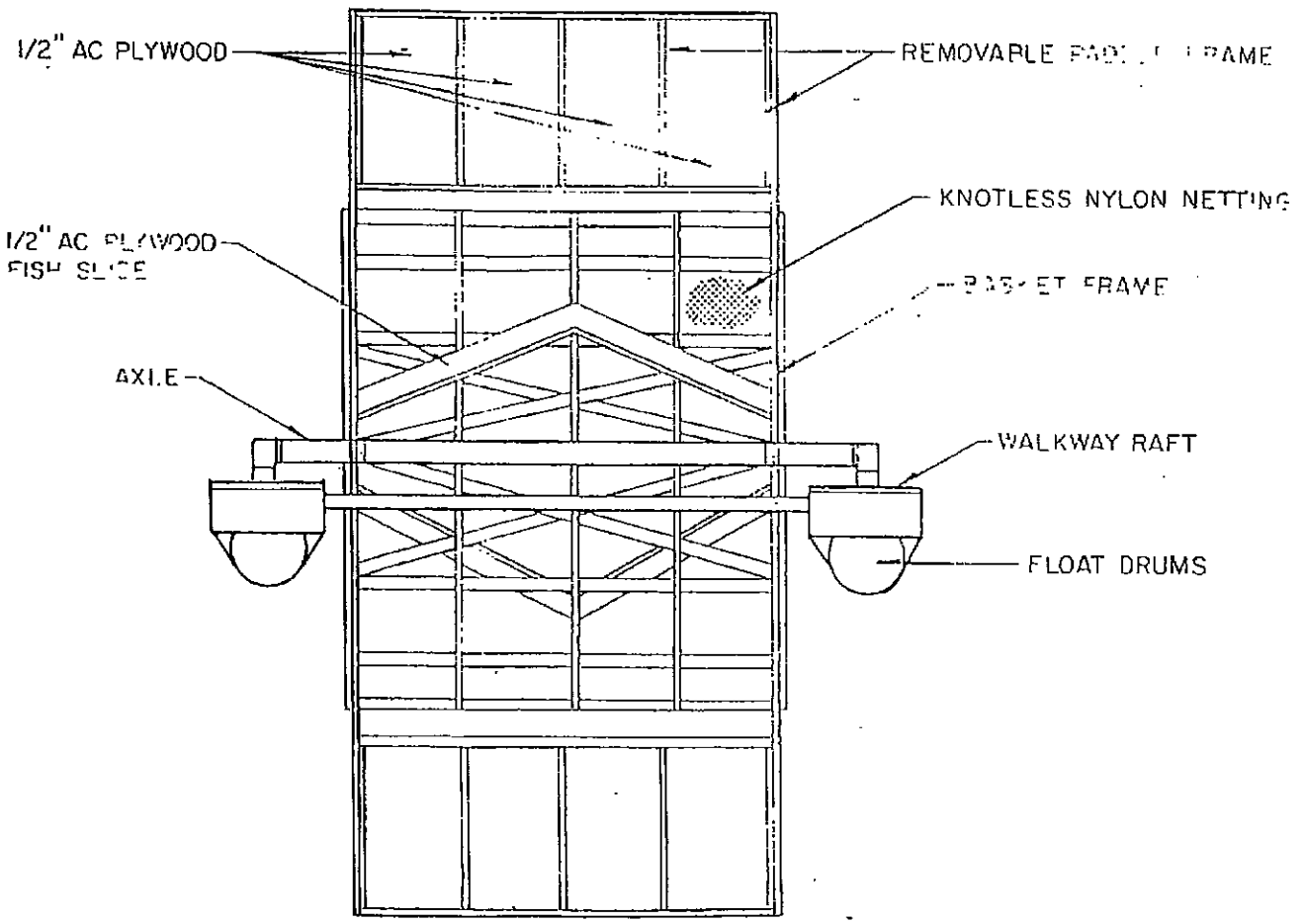

44"
19"
34"
145.000000°
140.000000°
135.000000°
8'-4 9/64"


WALKWAY RAFT
2'-6"
4" x 12" x 18' plank
1/2" LIFTING EYE
1/2" AC PLYWOOD FISH SLIDE
PADDLE SECTION
13'
34'-0"
AXLE
FRAMES
KNOTTLESS NYLON NETTING (STAPLED TO FRAME & BRACING)
3'-6"

FISHWHEEL - PLAN VIEW

SCALE: 3/8" = 1'-0"





– FRONT ELEVATION –