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LOG TRANSPORTATION BY BARGE
A CASE STUDY IN THE MARLBOROUGH SOUNDS

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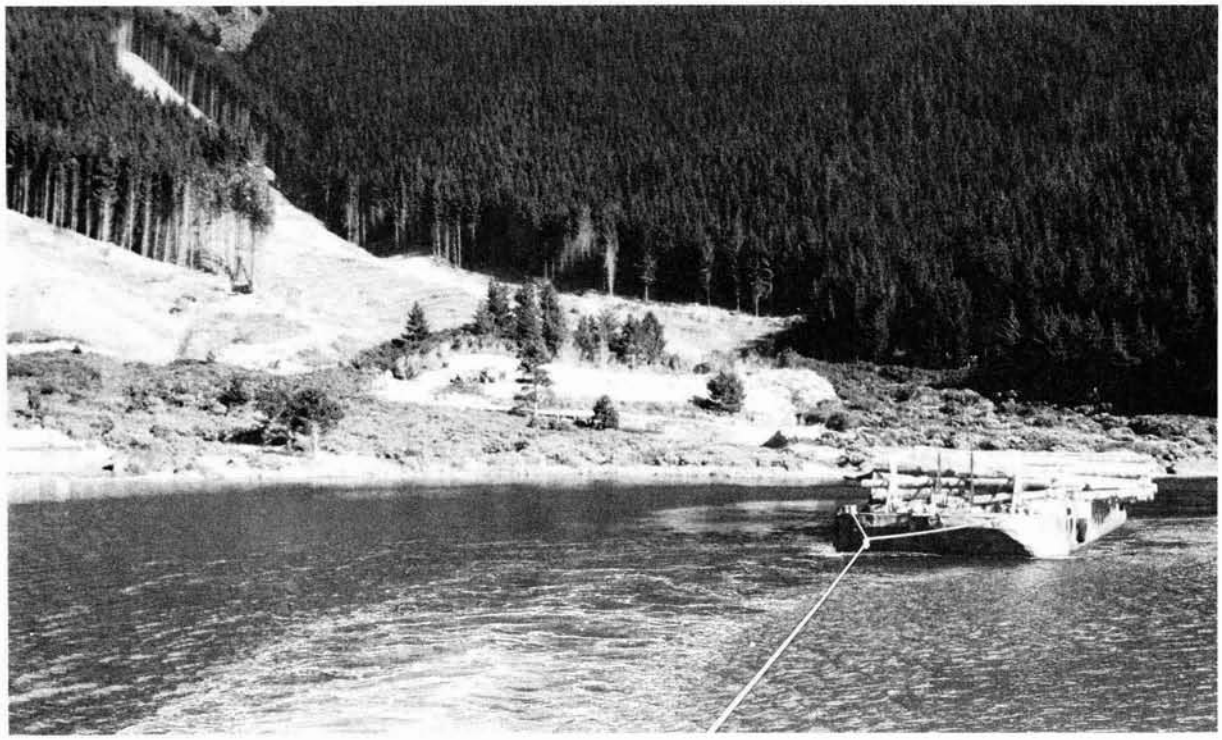

Figure 1 - Rahotia Forest, Onepua Bay, Marlborough Sounds

ABSTRACT

An operation transporting radiata logs by "dumb" barge in the Marlborough Sounds was studied. Detailed times for three complete cycles between Picton and the forest terminal at Onepua Bay (a distance of 19 km) were collected. Total cycle time averaged 8.35 hours and payload averaged 240 tonnes. Analysis of the data indicated that the following variables had the greatest impact on cycle times; the distance between barge terminals, the payload carried, the distance between the log storage areas and the barge, loader size and capacity, and log type and number of log types carried.

Careful planning has ensured that the environmental impact on the beach and foreshore is minimal.

Barging, in this instance, has proved to be an effective alternative to conventional transport by log truck.

INTRODUCTION

Virtually all of New Zealand's current logged volume is transported by road or rail. With some of the new areas to be harvested, e.g. Northland, East Coast and Marlborough, there is an increasing interest in the use of water-based transport methods as an economically viable alternative. This alternative has the potential to become very attractive where:

- land transport is difficult or long distances
- good loading/off loading facilities exist for water transport
- logs can be moved to the loading point as part of the logging operation, i.e. no double handling
- the final transport is export ship, i.e. logs do not need further transport from the off-loading facility by road/rail

Factors which may influence the decision to utilise a water-based transport option include :

- available shelter on the waterways
- the volume to be extracted
- the cost and environmental impact of upgrading existing access to logging truck standard
- the availability of a suitable water-based transport system

There have been examples of successful barging systems in New Zealand (McConchie, 1989). Overseas, barges are commonly used to transport large volumes of logs.

In planning to harvest the privately owned Rahotia Forest in the Marlborough Sounds, Forestry Corporation of New Zealand Limited was faced with making a decision on a suitable transport system for approximately 80,000 tonnes to be logged over an eighteen month period. Two issues required balancing; the environmental impacts and the economic viability of the transport system.

Barging was selected by the Forestry Corporation because it provided an efficient means of transporting the required volumes from the logging site to the point of export (Picton wharf). The key issues which influenced this decision included :

- extensive new roading on steep, erodible terrain
- access through adjoining properties
- impact of logging trucks on low quality county roads
- impact of logging trucks travelling through local towns

This Report examines specific environmental and operational requirements of the logging site barge terminal and the Picton wharf terminal. It discusses the physical attributes of the specific barge used and summarises a three day productivity study of the loading, transport and unloading.

ACKNOWLEDGEMENTS

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THE BARGING SYSTEM

Figure 2 - Launch hooked up to barge at Picton Terminal

The barge, owned by Johnson's Barge Service Limited has been used in for general cargo transport for several years (Figure 2). The barge is of a "dumb" configuration (i.e. it is towed or pushed, not self-propelled).

The launch "PAMIR" is used to push and tow the barge. The launch is of wooden construction, 15.1m in length and powered by a 197 kW, diesel engine. Two people are required to run the barge; one to operate the launch (with appropriate certification), and one to assist with general work and operate the stern thruster on the barge when manoeuvring at the terminals.

Barge specifications are :

Overall length	=	33.6m
Overall width	=	8.5m
Loading length	=	23.8m
Draught when loaded		2.0m
Net weight, empty	=	150 tonnes

The weight the barge can carry is limited by the load size indicated by the load line, not the ability to stack logs on. Within the Sounds, the typically calm conditions allow loads of 270-280 tonnes. Barging on more exposed water would restrict maximum load to approximately 200-240 tonnes and on some days barging may not be possible at all.

To reduce damage/buckling to the deck and bulwarks, the deck has been concreted and the hollow steel bulwarks filled with concrete (60-70 tonnes of concrete is being carried). The barge has further been modified to make it better suited for log cartage, including :

- hydraulically raised and lowered stern ramp
- stern thruster for better control manoeuvring at terminals
- hydraulic capstan winch for securing to foreshore anchors at terminals
- placing posts at the bow and side stanchions to improve load height
- moveable rudder extensions to improve "tracking" under tow

ONEPUA BAY BARGE TERMINAL

The logging site barge terminal is located on a broad deep debris fan below the main processing area (Figure 3 and 4).

Figure 3 - Onepua Bay barge terminal

The terminal consists of four components:

- a beach pad at the barging point
- a log storage area
- the main processing area
- an access corridor linking the beach pad, the log storage area and the main processing area

The beach pad consists of prefabricated grids of rail line, similar to a cattle stop, linked together over the 18m of beach between the low tide and high tide lines. The grids are strong, stable, self-cleaning and they protect the beach from the direct impact of the loader. The top layer of boulders on the foreshore was moved aside prior to placing the grids. At the end of the operation the beach pad will be removed and the boulders replaced as part of the site rehabilitation. Vegetation along the foreshore acts as a visual screen and as a "last resort" sediment trap.

The log storage area is located on a relatively flat site, 50m directly back from the beach pad. It covers an area of 0.11 ha. Steel posts are used along the log storage area boundaries to stop the storage area expanding in size. This storage area can hold more than 600 tonnes (2+ barge loads) in 6 log sorts. Currently all short pulp (3.6m) is retained at, and loaded from, the single main processing landing.

The main processing area is located above and behind the storage area, with the two areas linked by a broad sweeping access road wide enough to transfer 11m logs safely. The distance from the processing area to the storage area is 120m. All the production from the logging area passes through this processing area.

Logs are transferred from the processing area to the log storage area by the Cat 936E rubber tyred front-end loader outside barge loading times. At a production rate of around 250 tonnes/day, the loader can comfortably cope with barge loading, log transfer and some skidwork.

An 8m wide access corridor through the foreshore reserve links the storage area and the beach pad. Access has been physically marked, the surface vegetation removed and retained for later rehabilitation of the site. Close attention is paid to water control on the roadways.

The link between the beach pad and the barge ramp is provided by a moveable section of ramp with a set of wheels at one end (a "wheelbarrow"). This can be lifted by the loader and wheeled along the beach pad to meet the barge ramp to which it is securely chained prior to loading. This "wheelbarrow", adjusts the loading angle and ensures loading can continue at any stage of the tide. During loading, the barge may need to reposition because of tidal movement.

PICTON TERMINAL

The unloading facility at Picton is a permanent feature and is used by local barge operators for a range of cargo handling operations. It has been used for handling logs in the past (McConchie, 1989). The site has a partly sealed, hard, well drained surface with an available log storage area of approximately 0.65 ha. The maximum log storage capacity is approximately 4,000 tonnes (15-16 barge loads but up to 6,000 tonnes have been accumulated with some operating difficulty.

DESCRIPTION OF A BARGING CYCLE

A full cycle from Picton to the logging site, loading, return to Picton and unloading takes between seven and eight

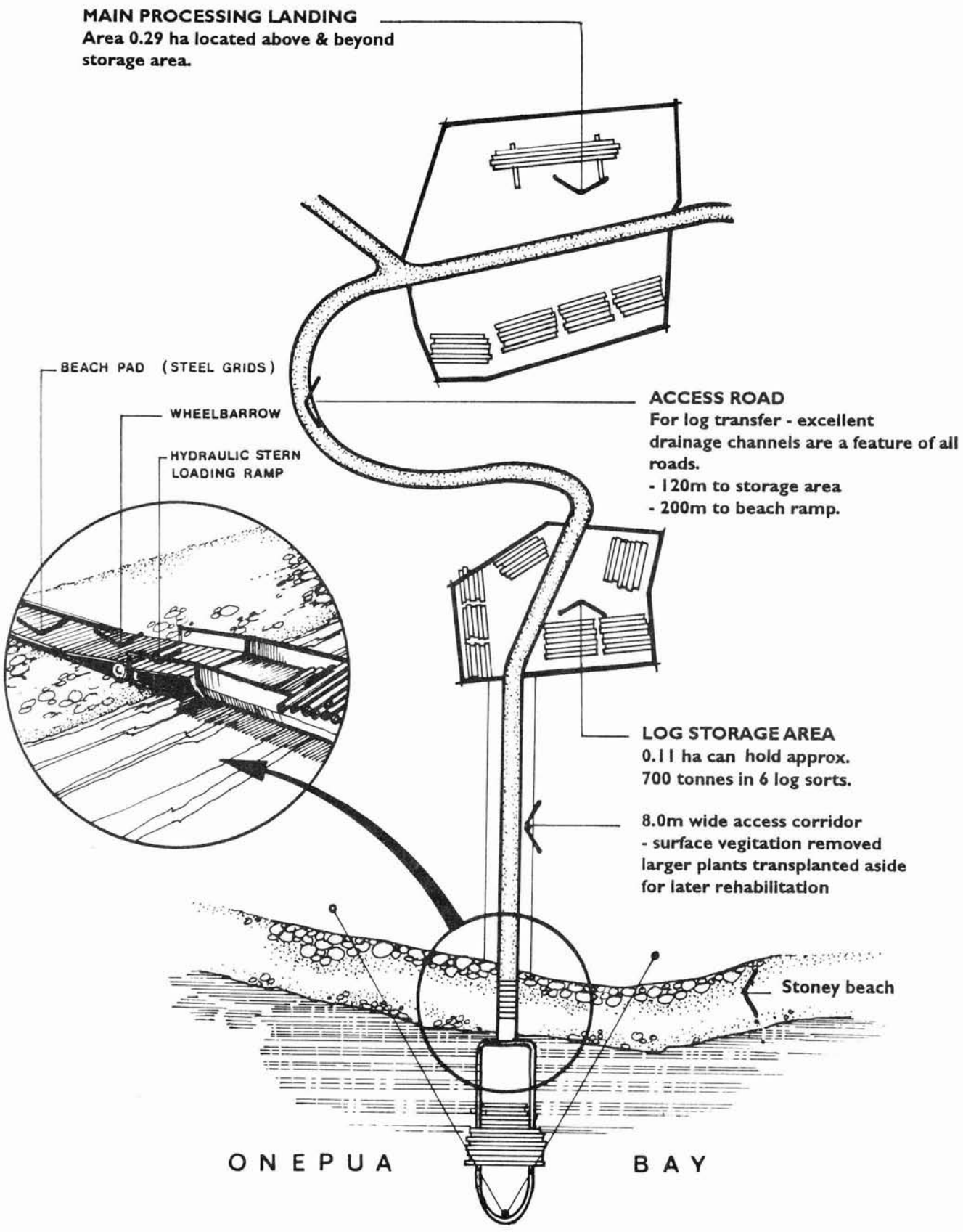

Figure 4 - Layout of processing, storage and loading areas - Onepua Bay

hours. The cycle comprises :

Preparation

Preparation normally takes 10-12 minutes and involves starting the launch, releasing the barge from the shore anchors and manoeuvring out from the berth.

Travel Empty

The barge is normally pushed stern first but is towed in rough water conditions. The distance to the logging site is approximately 19 km and takes around 1 hour 40 minutes, at a speed of 11-12 km/hr. Tide and wind both have a significant effect on travel times which explains much of the 10 minute observed difference.

Berth at Loading Point

Berthing takes about 10 minutes. The barge is brought in slowly and positioned directly out from the beach pad. Ropes from the barge are attached to shore anchors, one on either side.

Barge Loading

A Caterpillar 936E (93 kW, 14 tonne operating weight) rubber tyred front-end loader is used to load the barge (Figure 5). Loading times can vary considerably and for the three loads observed ranged from less than 2 hours to over 3 hours. The key factors affecting loading time are the source of the logs, i.e. the storage area (50m) or the processing landing (200m), log type and overall barge payload.

A loading time of less than 90 minutes is possible when all logs are loaded from the log storage area and only long sawlogs are loaded.

Figure 5 - Barge loading, showing the beach pad, wheelbarrow and shore anchor

Depart Loaded

Release the barge from the "wheelbarrow" and shore anchors, pull in the ropes, manoeuvre out into the bay and prepare to tow. This takes about 10 minutes.

Travel Loaded

The barge is towed bow first by a 40-50m single rope (Figure 6). Speed is governed by engine speed and is affected by tides and wind. Average speeds of 9-10 km/hr were observed.

Figure 6 - Loaded barge under tow

TABLE 1
SUMMARY OF TIME STUDY DATA

Operation/Details	*Trip 1*	*Trip 2*	*Trip 3*
	(All times in minutes)		
1. PREPARATION - start up launch, untie barge, manoeuvre out of harbour	10.5	10.7	10.5
2. TRAVEL EMPTY - Picton to Onepua bay approximately 19km	94.9 12.0km/hr 6.5 knots	98.6 11.6km/hr 6.2 knots	105.5 10.8km/hr 5.8 knots
3. BERTH AT LOADING POINT - Forest terminal, Onepua Bay	8.8	10.4	11.4
4. LOAD BARGE (Cat.936E)	192.3	111.5	113.8
5. DEPART LOADED - untie barge, manoeuvre out into bay, prepare to tow.	8.3	10.6	9.2
6. TRAVEL LOADED - Onepua bay to Picton, barge under tow	121.5 9.4km/hr 5.1 knots	115.7 9.9km/hr 5.3 knots	118.2 9.6km/hr 5.2 knots
7. BERTH AT UNLOADING RAMP - Picton Terminal	21.3	18.8	18.5
8. UNLOAD BARGE (Cat.966E)	86.2	61.5	92.4
9. DELAYS (discussion - reposition barge)	10.6 N/A	3.6 N/A	11.3 16.6
10. CLOSEDOWN (i.e., no loads on following day)			
TOTAL TIME	**554.4 9 hours 15 mins**	**441.4 7 hours 21 mins**	**507.4 8 hours 27 mins**

NOTE: (1) Refuelling is currently required after about 16 trips.This usually takes 40-50 minutes, say on average 3 minutes/barge cycle.

(2) Closedown occurs every 4-5 cycles (so say 3-5 mins/cycle).

TABLE 2
BARGE PAYLOAD DETAILS (No of Logs)

			Trip 1	*Trip 2*	*Trip 3*
	Sawlogs (length)	11.0m	117	41	59
		7.3	84		50
		5.4		274	
		3.6	177		219
	Pulp (length)	7.3		227	
		5.4			361
		3.6	189		
	TOTAL		**567**	**542**	**689**
Log Source	- Processing Landing		38 Cycles (66%)	8 Cycles (18%)	4 Cycles (7%)
	- Stockpile		20 Cycles (34%)	37 Cycles (82%)	50 Cycles (93%)
Weight (tonnes)	- Sawlogs		233 (90%)	157 (73%)	170 (71%)
	- Pulp		27 (10%)	59 (27%)	71 (29%)
	TOTAL (tonnes)		**260**	**216**	**242**

TABLE 3
(A) EFFECT OF LOG SOURCE ON BARGE LOADING
(Average times/loader cycle - Cat 936E)

Element	*Log Storage Area (50m travel) (minutes)*	*Main Processing Landing (200m travel) (minutes)*
Travel Empty	0.26	1.10
Collect Logs	0.63	1.51
Travel Loaded	0.25	0.78
Load onto Barge	0.77	0.77
TOTAL (minutes)	**1.91**	**4.16**

(B) BARGE UNLOADING
(Average time/loader cycle - Cat 966E)

Element	*Minutes*
Collect Logs from Barge	0.88
Stockpile logs at terminal	1.00
TOTAL (minutes)	**1.88**

TABLE 4
EFFECT OF LOG TYPE ON LOADING AND UNLOADING PRODUCTIVITY

	Sawlog (Length)				*Pulp (Length)*		
LOADING	11.0	7.3	5.4	3.6	7.3	5.4	3.6
No. of loader cycles observed	40	14	25	37	13	18	10
Total Logs	217	134	274	396	227	361	189
Logs/cycle	5.4	9.6	11.0	10.7	17.5	20.1	18.9
* Estimated piece size (tonne)	1.06	0.63	0.43	0.33	0.26	0.20	0.14
Payload/cycle (tonnes)	5.8	6.0	4.7	3.5	4.5	4.0	2.7
** UNLOADING							
No. of loader cycles observed	16	12	22	24	8	16	3
Total Logs	112	134	274	308	227	361	76
Logs/cycle	7.0	11.2	12.5	12.8	28.4	22.6	25.3
Payload/cycle (tonnes)	7.4	7.0	5.4	4.2	7.4	4.5	3.5

* *All logs are measured individually for JASM at the Picton Terminal JASM has been converted to tonnes by using a factor of 1.15. The total tonnage in each log class divided by the total number of logs generates the estimated piece size.*

** *Incomplete unloading data was collected on Trip 1.*

Berth at Picton Terminal

Prior to berthing, the launch must link up alongside the barge again and pull in the towline (6-8 minutes). Where this occurs will depend on wind and sea conditions and other vessels in the vicinity. The barge is brought into the terminal, then the launch is shut down. The berthing procedure normally takes approximately 20 minutes.

Unload Barge

A Caterpillar 966E (161 kW, 20 tonne operating weight) rubber tyred front-end loader is used to unload the barge. Unloading takes 1-1.5 hours. The unloading is affected by the payload, the log types carried and how well the log types are segregated on board. The larger loader at the unloading terminal results in improvements in unloading productivity/cycle of around 25% (Table 4).

DISCUSSION

The size of this barge matches the scale and type of operations in the Marlborough Sounds.

During a week, the barge is expected to carry four to five loads. However, this is not always achieved due to logging difficulties. Based on details supplied by the Forestry Corporation of New Zealand Limited for 23 barge loads, the average payload was 263 tonnes (minimum 202 tonnes, maximum 324 tonnes). The two operators live on the launch during the week while loads are available. At times, two loads may be shifted in a single (24 hour) day, although currently they must return to the forest terminal prior to the logging crew departing. Continuity of work can be a problem, and one advantage of a "dumb" barge system such as this is that the launch and/or barge can be used for other work if it is available.

The use of rubber tyred front-end loaders is essential in this type of operation for rapid loading and unloading of the barge, and their ability to move logs quickly over relatively long distances.

The barge terminal at Onepua Bay can be regarded as almost ideal except that it is a little exposed to the wind. It is unattractive for recreation, and shelves gently before dropping off into deeper water enabling loading at any stage of the tide. The log storage area is small in size compared with the volume of logs it can handle, flat and close to the loading point and it required little site disturbance to prepare. Prior to commencement of this operation, the Department of Conservation and the Nelson-Marlborough Regional Council insisted on a bond being paid to guarantee restoration of the site after harvesting. To date, the impact has been minimal and it will be returned close to original condition at the completion of harvesting. The terminal is an excellent demonstration of minimal environmental impact brought about by thorough planning and by a commitment from all parties concerned to ensure the success of the operation.

REFERENCES

McConchie, M. (1989) : "Taking a Punt" - Barging Logs in Marlborough". N.Z. Forest Industries, October, pp 20-23.

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