Forestry

Earthworks & Harvesting Guidelines for Northland

Issue 3 – July 2022

NORTHLAND
FORESTRY
ENVIRONMENTAL
WORKING GROUP

FOREWORD

The intent of this guideline is to provide information on practices and methodologies that will minimise any erosion and consequently sedimentation that may arise from forestry practices. The following guidelines should be read while taking into account the social and economic responsibilities of forestry companies to be consistent with the Resource Management Act 1991 and subsequently the National Environmental Standards for Plantation Forestry.

Practices relating to run-off control are based around the theory of dilute and disperse water resulting in multiple small devices, preferable to one large device, to treat and disperse run-off. The guidelines provide a toolbox approach to minimise run-off and sediment control.

This guideline does not replace or override in any manner other statutory requirements such as: Health and Safety at Work Act 2015, Resource consents from Northland Regional Council (NRC) and various territorial authorities, and National Environmental Standards for Plantation Forestry.

Note, that rules administered by district councils are also not covered in these guidelines.

In addition, it is suggested that you contact NRC to determine the status of the relevant activity proposing to be carried out to confirm that your operation, including any works proposed in water bodies, complies with the relevant regulations.

This document was originally formed in collaboration with
Northland Regional Council,
Hancock Forest Management (NZ) Limited
Rayonier / Matariki Forests
Chandler Fraser Keating Limited
Northland Forest Managers (1995) Limited
PF Olsen Limited
Summit Forests New Zealand Limited

The 2021 update of this document was completed by the Northland Forestry Environmental Working Group, a subsidiary of the Northland Wood Council in collaboration with the Northland Regional Council.

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PURPOSE

These guidelines have been developed by the Northland Forestry Environmental Working Group that includes key stakeholders and the Northland Regional Council (NRC). The intent of this document is to provide NRC and the forestry industry (including contractors operating under permitted activity and/or a resource consent) with a document to help with undertaking operations and monitoring by providing examples of best practice. The document is a guideline only and provides a toolbox approach illustrating several different examples on how to achieve good environmental outcomes.

Following the practices in this guideline will assist in minimising erosion and sedimentation that may arise from forestry operations and help forest managers and contractors meet their statutory requirements. As a guideline this document has no statutory weighting and does not replace resource consent conditions that may be held, regional or district plan rules or permitted activity criteria outlined in the National Environmental Standards for Plantation Forestry 2017 (2018).

To determine whether you need a resource consent or whether the works fall under the permitted activity rules, refer to the flowcharts attached as Appendix 2, 3, 4 and 5 of these guidelines. If in doubt, contact NRC.

INTENT OF GUIDELINES

These guidelines have two major objectives:

1. Provide user friendly technical guidance on erosion and sediment control methodologies that are in line with current best practice and suited to the Northland landscape.
2. Create better environmental outcomes through minimising erosion, sediment discharges and sedimentation as a consequence of land disturbance.

These guidelines will be updated periodically in response to changes in legislation, policies, technologies, national standards and feedback from industry.

OTHER REFERENCE MATERIAL

Other material that this document should be used in conjunction with is:

- NES-PF National Environmental Standards for Plantation Forestry
- NZFOA Environmental Code of Practice for Plantation Forests
- Proposed Regional Plan for Northland
- NRC Regional Water and Soil Plan for Northland (RWSPN) dated August 2004
- NRC Regional Air Quality Plan for Northland dated 2003
- NZ Environmental Code of Practice for Plantation Forestry
- NZ Forest Road Engineering Manual
- Kaipara, Whangarei and Far North District Plans

PLANNING FLOW CHART

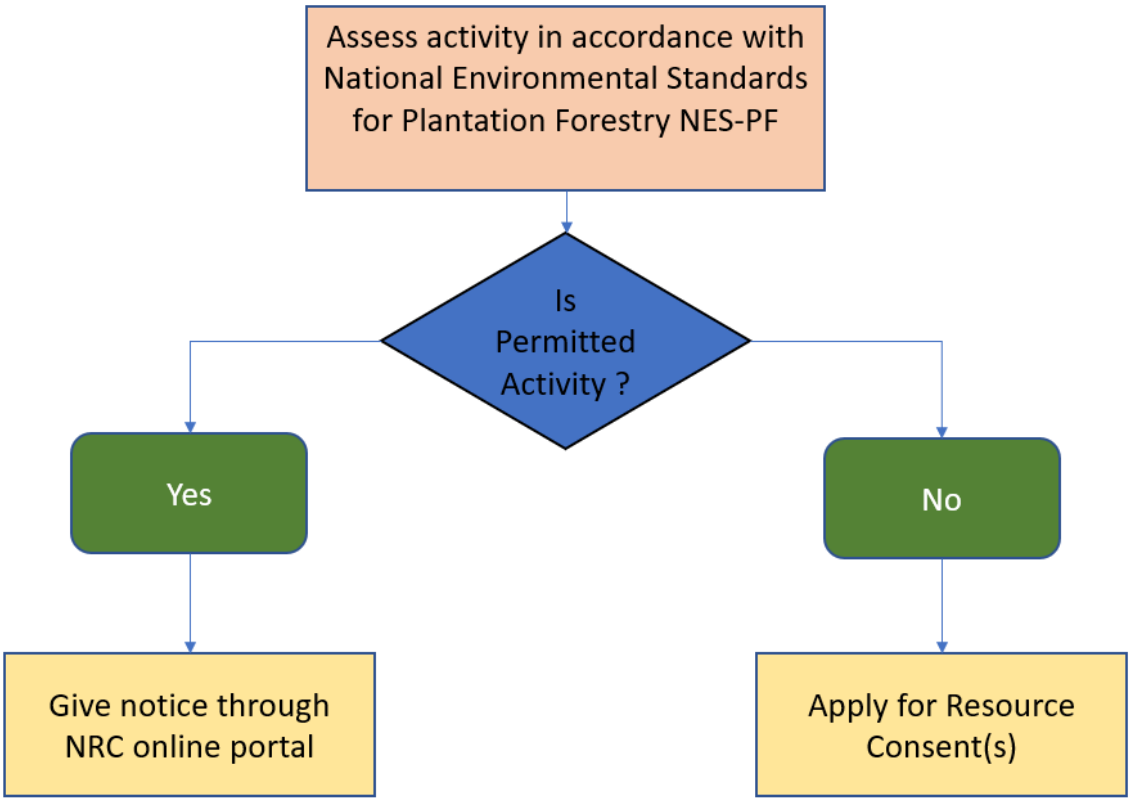


Figure 1. Planning flow chart for meeting the necessary statutory obligations of the NES - PF before undertaking forestry activities. Note that you may be required to provide further information once giving notice depending on the activity being undertaken.

Note that you may need to notify permitted activities, as well as apply for resource consent. For example, for a harvest and earthworks plan with river crossings: if harvesting and river crossings can comply with NES-PF permitted activity regulations, but earthworks, or a part of earthworks, cannot, then permitted activity elements must be notified through the NRC online portal AND application for resource consent must be made for the activities which cannot comply with the permitted activity regulations.

One way would be to provide a holistic notification under NES-PF regulations, in which the activities which require resource consent are highlighted and resource consent is applied for referencing the full set of plans and adding required assessments and documentation for the activities requiring consent.

GIVING NOTICE FOR FORESTRY ACTIVITIES

A standard requirement for undertaking the forestry activities discussed in this guide is providing notice to your local Regional or Territorial authority. In Northland notice only needs to be given to NRC who provide a one stop shop for all NES-PF notices.

The purpose of this requirement is to inform council of these activities and enable them to undertake compliance monitoring where appropriate. It is also an opportunity for NRC to engage with the industry and provide guidance where necessary. The below table provides an overview of requirements for written notice in the NES – PF.

Activity	Regulation	Consent authority	When required	Written notice of:	Timeframes
Earthworks	25	Regional council	If *earthworks* involve more than 500m² of soil disturbance in any 3-month period.	• The place where *earthworks* are to be carried out The dates on which the *earthworks* or road widening, and realignment are planned to begin and end • If a forestry earthworks management • plan is required (if applicable)	• At least 20 and no more than 60 working days before the date on which the *earthworks* or road widening and realignment are planned to begin; or • A minimum of 2 days before the date on which any *earthworks* that are required for *salvage operations* are planned to begin; or • Annually, in the case of ongoing earthworks.
River crossings	38	Regional council	The construction or removal of all *river crossings.*	• The date on which the construction or removal of *a river crossing*, other than a *temporary river crossing*, is planned to begin • The location of the river crossing.	At least 20 and no more than 60 working days before the date on which the *river crossing* activity is planned to begin.

Forestry quarrying	52	Regional council and territorial authority	If the volume extracted from a forest quarry exceeds 200 m^3 in any calendar year.	• The place where the *forestry quarrying* is to be carried out and the proposed *setbacks* (including a description of how they were calculated) • The dates on which the *forestry quarrying* is planned to begin and end • If a quarry erosion and sediment management plan is required (if applicable).	• At least 20 and no more than 60 working days before the date on which the *forestry quarrying* is planned to begin; or • Annually, in the case of ongoing *forestry quarrying*.
Harvesting	64	Regional council and territorial authority	All *harvesting* activities.	The place where *harvesting* will be carried out • The dates on which the *harvesting* is planned to begin and end.	• At least 20 and no more than 60 working days before the date on which the *harvesting* is planned to begin; or A minimum of 2 days before the date on which *harvesting* required for *salvage operations* is planned to begin; or • Annually, in the case of ongoing *harvesting* operations.

Table 1: When to give notice for forestry activities

As well as providing notice, NRC also requires all harvesting and earthworks notices be accompanied by a management plan in accordance with schedule 3 in the NES – PF. See appendix 12 for the schedule 3 checklist.

To submit a notice to NRC and for more information on giving notice/management plan process please visit https://www.nrc.govt.nz/environment/forestry/

1 ENGINEERING

1.1 Earthworks

Objective: To construct a road, track or landing fit for purpose while recognising safety, production, implementation of current good practice, and minimising on-site earth disturbance and associated off-site effects.

A plan must exist for all roads, tracking or landing prior to the commencement of works.

1.1.1 Pre-construction Planning

Before undertaking planning, identify the Erosion Susceptibility Classification (ESC) of the land area involved. Links to the ESC maps are available on the NRC or MPI websites (Refer appendix 6). The below table shows the permitted activity thresholds for earthworks in the four different ESC zones. Earthworks outside of that described in the table will require a resource consent, contact NRC for guidance.

ESC Zone		Risk rating	New earthworks volume thresholds for PA	Maintenance earthworks volume thresholds for PA	Forestry road widening or realignment thresholds for PA
Green		Low risk	NA	<5000m³/3 months	<5000m³/3 months
Yellow		Moderate risk	NA	<5000m³/3 months	<5000m³/3 months
Orange	<25° Slope	High risk	NA	<5000m³/3 months	<5000m³/3 months
	>25° Slope	High risk	Side cutting to a height of 2m to 3m over no more than 100m continuous length. The deposition of less than 500m³ of fill.	<5000m³/3 months	<5000m³/3 months Construction of a bench below a forestry road to contain and stabilise the fill slope keying and compacting the fill to the bench
Red		Very high risk	Side cutting less than 2m deep over no more than 50m continuous length. The deposition of less than 100m³	<5000m³/3 months	<5000m³/3 months Construction of a bench below a forestry road to contain and stabilise the fill slope keying and compacting the fill to the bench

Table 2: Permitted activity earthworks in different ESC zones

Once ESC is determined the following critical construction points should be considered:

- Stream crossing points.
- Large cut and fill area and end haul sites.
- Stormwater and sediment control measures required.
- Slash management plan (benching and slash security).
- Geology and soil type.
- Topography.
- Prior slips, slumps or land movement.
- Identification of sensitive water bodies, water takes and significant natural areas.
- Exit / entry points to public infrastructure.
- Road specifications (grades, width).
- Landing specifications
  - Length
  - Width
  - Slope
  - Entrance
  - Load out strip
  - Truck turn around
  - Parking
  - Bulk fuel storage
- Infrastructure locations including wood flow directions.
- Climatic variables (stormwater flow paths).
- Available equipment and resources.
- Archaeological sites.
- Identifying tracks that require engineered construction (refer Appendix 1: Definitions for “Engineered tracking”).

All infrastructures should be maintained in a state fit for the intended use. Once intended use is finished infrastructure should be decommissioned or maintained accordingly.

1.1.2 Formation Works for Roading, Landings and Engineered Tracking

Items to consider:

- Stripping and placement of slash and overburden.
- Security of fill (benching and compaction).
- Stability of batter slopes.
- Mass haul cut / fill balancing (end hauling, cut to waste, management of waste spoil dump sites).
- Cross fall (stormwater management and fill face proximity).
- Root cluster placement (away from fill faces and safe from movement at harvest).
- Additional contributing catchment.
- Available equipment and resources.
- Minimise disturbance in earthflows and gullies

Material being end hauled rather than side cast should be considered when working in close proximity to sensitive receiving environments. It is required by the NES - PF to end haul material that cannot be benched in a manner that retains stability and when working on slopes >35 degrees (70 percent).

This photo shows a well compacted and stabilised side cast. Hydroseeding, recently applied, has not yet germinated.

Side cast material is well consolidated and contained by a slash bund at toe of fill to be vegetated at a later date.

1.1.3 Stabilisation and Containment

The NES – PF requires stabilisation of exposed areas of soil (except fire breaks) as soon as practicable after completion of the activity. Stabilisation and containment techniques to be considered for use on fill faces, side cast and unstable cut batters when undertaking roading, landing construction and engineered tracking including:

- Hand over-sowing.
- Mulch / hay.
- Slash on lower gradient stable slopes
- Transplanting of vegetative material, e.g. kikuyu.
- Riprap or rock armouring of water tables.
- Geotextiles.
- Aggregate.
- Hydroseeding.
- End hauling material to a stable location.
- Benching to contain fill.
- Slash bunding to contain sediment.
- Silt fences to contain sediment.
- Compaction and consolidation of fill/side cast material.

Vegetative stabilisation is generally improved by application of appropriate fertiliser mix suitable to the soil type.

Refer to section 1.1.4 - Stormwater Control.

Photo shows a good coverage of hydroseeding along fill areas of an access road

Mulching of fill areas is suitable as long as effective coverage is achieved and is not applied during wind, unless mulch is wet to hold in place.

Slash used as an alternative to stabilise fill embankments on stabilised low gradient sites.

Slash covering haul track

Haul track mulching

Effective hay cover for stabilisation

Fill must not contain more than 5% woody vegetation. This bund requires compaction and the hay mulch cover is too sparse to be effective for stabilisation.

Insufficient stabilization, a thicker slash cover is required or the addition of hay mulch.

1.1.4 Stormwater Control

Good practice relating to stormwater and sediment control is based around the theory of dilute and disperse water using multiple small devices rather than one large device.

Matters to be considered when installing stormwater controls for construction of roads, landings and engineered tracks include:

- Spacing and dimension of culverts appropriate to grade and catchment.
- Culvert type applicable to site (solid pipes through fills, bunds).
- Discharge points from stormwater controls onto stumps, through slash, or onto original ground.
- Fluming onto original hard ground (avoid fill and side cast material, previous landslips)
- Proximity to water bodies.
- Clearly identify location of culvert for ease of maintenance, e.g. a white wooden peg.
- Ability to access for maintenance
- Available equipment and resources.
- Timing of subsequent forestry operations.

Sediment control techniques that should be incorporated into stormwater controls could include the following:

- Sediment traps (established at 1:3 ratio)
- Silt fences
- Hay bales
- Grass
- Riprap
- Slash at outflows
- Roughning (Sloven large rock) placed in water table to reduce run-off velocity
- Bunding (earth or slash)
- Fluming onto original hard ground (avoid previous landslips).

Sediment traps should be placed below the base of the culvert inlet in order to effectively trap sediment. Where possible a sediment trap to slow discharge velocity should also be placed at the outlet from the culvert.

Stormwater culverts must be no less than 325mm internal diameter in green, yellow and orange zone <25 degree slope. Culverts shall be no less than 375mm internal diameter in orange zones >25 degree land slope and red zones.

Sediment traps involving the use of earth bunds are not advisable on steeper slopes (35 degrees or 70 percent) as there is a greater potential for collapse. Slash bunds may be a good alternative in these situations.

Culverts should be placed at a spacing that ensures water tables are not scoured or significantly deepened. Refer to table on next page.

Road Grade	Soil Type	
	ESC Green, Yellow and <25° Orange zones	ESC >25° Orange and all Red zones
18% (1 in 6)	80	40
14.5% (1 in 7)	90	50
12% (1 in 8)	100	55
11% (1 in 9)	115	60
10% (1 in 10)	130	65
8% (1 in 12)	165	80

Table 3: Recommended Culvert and Side Drain Discharge Maximum Spacing (metres)

If culvert spacing is unobtainable or impractical, water tables should be stabilised or armoured to minimise erosion and diameter increased to reflect additional flow.

An example of a poorly constructed sediment trap. Sediment traps need to be constructed in cut earth rather than fill and water must not be diverted to fill. If inflow or outflow does go through fill, then flume stormwater onto solid ground. Ensure outflow is on good solid ground with slash or long grass to assist with sediment retention.

The two photos below show examples of correctly functioning sediment traps at culvert inlets. All must be capable of being cleaned out and maintained.

An effective working sediment trap will require maintenance after significant rain events.

This photo illustrates that a well constructed slash bund on the outlet of a culvert can act as a very effective sediment filter. Note the NES – PF requires sediment controls to be maintained.

This photo illustrates a well constructed sediment trap with good length / width ratio (3:1), easy inflow and secure stabilised outflow.

Plastic flumes taking water over fill to stable ground. Flumes must be secured as 1 litre of water = 1 kilogram.

A flume sock taking water over fill to stable ground. Sock needs to be fixed well to culvert to ensure water does not undercut. Ensure sock is fixed well for entire length (particularly outflow) to avoid twisting of sock which can lead to sock filling with water and pulling off culvert.

A landing without stormwater control.

A landing with effective water diversions and well-spaced sediment traps to service the area.

1.2 Road Construction

Objective: To construct a road fit for purpose while recognising safety, production and environmental compliance requirements.

Every road construction project within a forest must have a plan.

You must have a plan for:

- Location and specification of road intending to be constructed
- Minimisation of soil disturbance in the overall access design
- Site formation management to minimise adverse effects; and
- Post-construction maintenance.

This photo shows that a well constructed road will safely accommodate logging trucks.

1.3 Landing Construction

Objective: To construct a landing fit for purpose while recognising safety, production and environmental compliance.

A plan must be in place before the commencement of any works associated with landing construction.

You must have a plan for:

- Location and specification of landing intending to be constructed
- Minimisation of soil disturbance in the overall design
- Site formation management to minimise adverse effects; and
- Post construction maintenance.

A correctly planned bench will contain all compacted soil and still be visible at the end of construction.

Bunding, slash and root balls should not be overtopped with fill material.

A designated spot for root balls should be planned and not be incorporated into fill areas. However, where necessary root balls can be placed at the edge of the fill or where there is minimal fill.

All root balls must be placed where they are secure and will not cause health and safety issues for all forestry operations, operating below or around root balls.

Refer section 1.1.4 – Stormwater Control.

A poorly engineered landing most likely due to insufficient benching and water control resulting in failure.

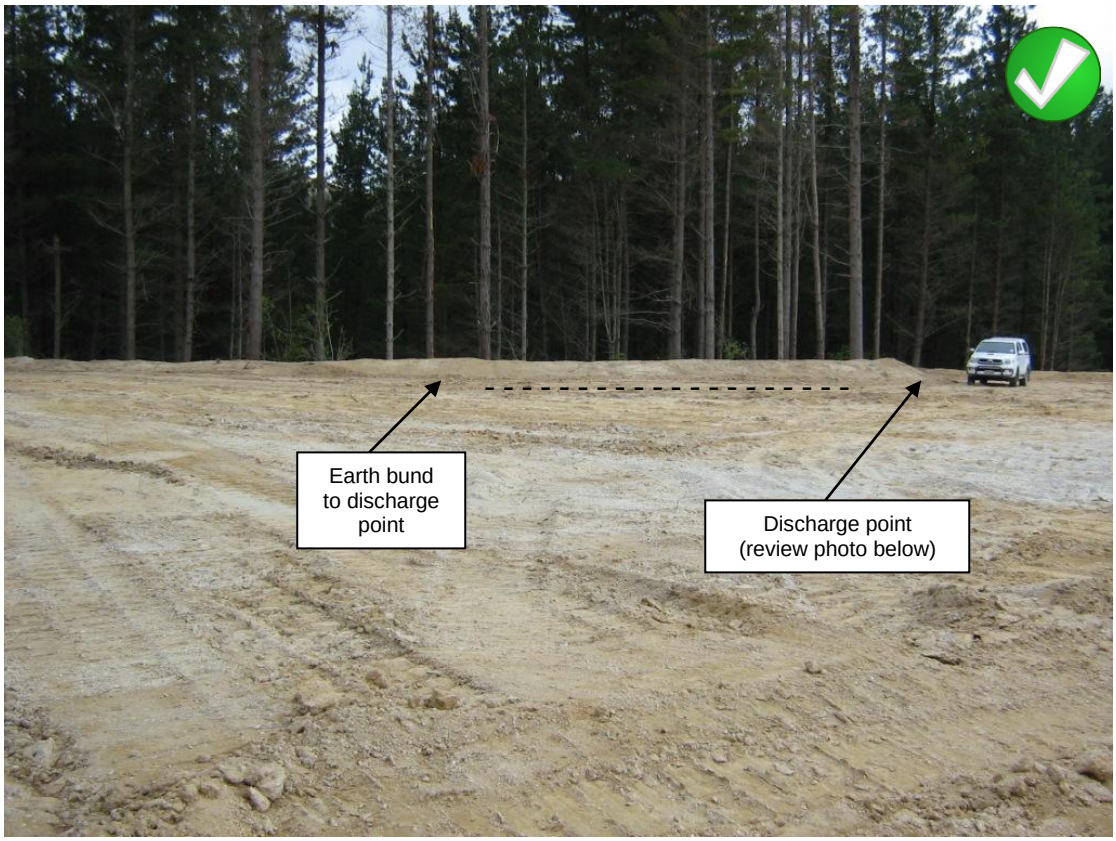
Over burden pushed onto a visible bench. The bench should be visible after the construction.

A visible bench with stumps and slash stored in stable location.

Landing shows bench still visible after construction with root balls in stable location.

A well finished landing with a stable batter and water table leading to discharge point at end of batter on stable ground.

Water discharged through managed point. These are removed just prior to harvest. Landing edge has been bunded to protect fill slopes.



A well-constructed landing

2 TRACKING

2.1 Formation of Tracks

Objective: To construct a forestry track fit for purpose of facilitating and providing safe access for both ground based and hauler harvest equipment, while recognising safety, production and environmental compliance requirements.

Under the NES - PF, tracking for machine access and tree/log extraction must be included in the Earthworks Management Plan, if it is anything more than simply machine passage over existing ground. Note that forestry roads and tracks are defined as being earthworks, see definition in Appendix 1

Items to be considered when planning forestry tracks works include:

- Actual need for track
- Minimise fill/side casting of material (e.g. cuts for track formation)
- Grade
- Soil type
- Length
- Proximity to water bodies
- Time of year
- Stabilisation (slash / mulch etc.)
- Disestablishment requirements to manage water run-off.

As per point 4 of Schedule 3 (refer Appendix 11) to the NES-PF regulations, this plan should:

- Identify the area to which the plan applies
- Describe the scope of work covered by the earthworks and whether it is for maintenance, upgrade, road widening, realignment, or new works.
- Indicate the anticipated construction time for forestry earthworks and stabilisation:
- Describe clearly the management practices that will be used to avoid, remedy, or mitigate risks due to forestry earthworks that have been identified on the map, including the proposed erosion and sediment control measures to be used and the situations in which they will be used, in sufficient detail to enable site audit of the management practices to be carried out:

- Include the following for earthworks management:

  (i) water run-off control measures
  (ii) sediment control measures during construction and during harvest
  (iii) the method used to manage excess fill for large-scale cut and fill operations, and if end haul, the proposed disposal location
  (iv) methods used to stabilise batters, side cast, and cut and fill
  (v) post-harvest remedial work (timing and methods).

Where practical all tracks should be placed in locations where they avoid creation of concentrated stormwater flow paths. Tracks should not be placed in depressions or the lowest point of dry gullies.

This constructed track has no water controls or stabilisation

A well constructed track but lacking effective sediment controls. Sediment traps should have diversion drains to direct water, be constructed on virgin ground and be sized appropriately.

A track without appropriate sediment control

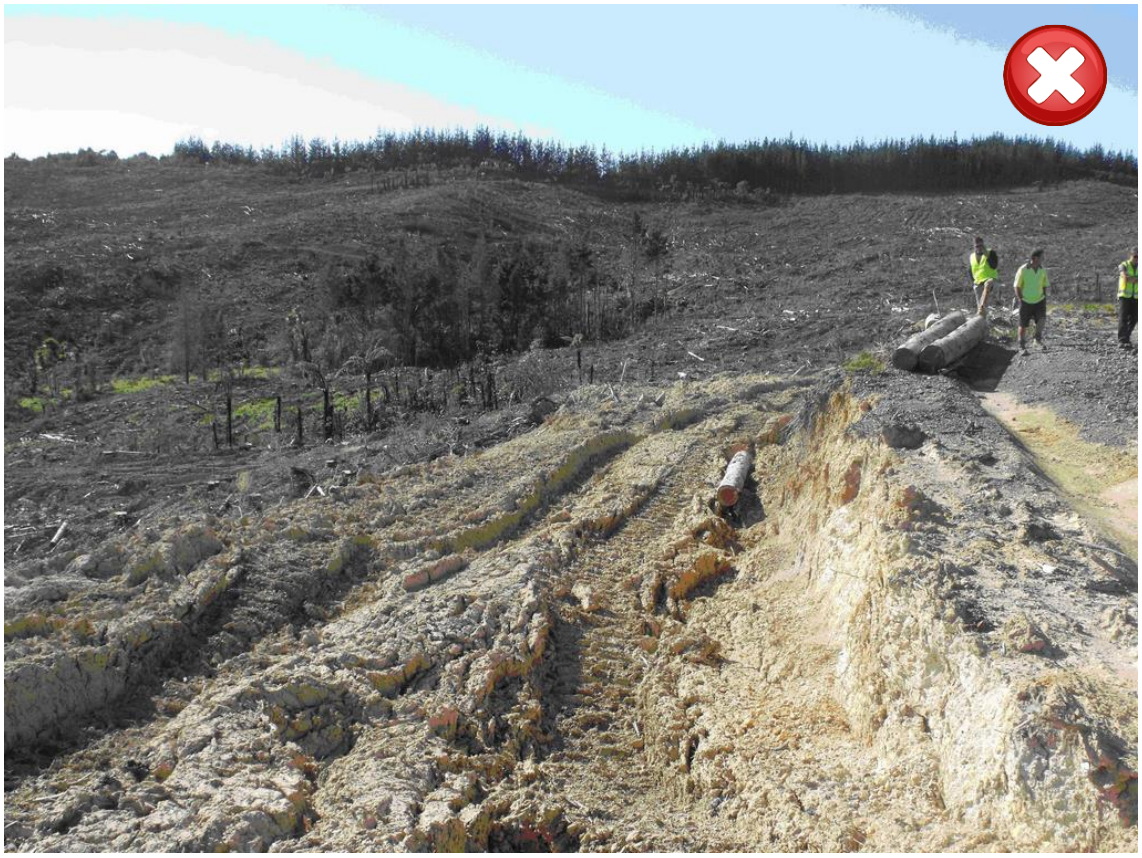


Photo below shows correct use of cut-outs for water control

2.2 Storm Water Control while Track is in Use

Once in use, it is considered good practice to temporarily disestablish a track prior to a storm event occurring if part of the track is close to a waterway or a sensitive receiving environment so as to minimise erosion and avoid sediment discharge. The same disestablishment should be considered if the track is not being used for a period of time, e.g. not in use over the Christmas period.

To avoid doubt, the length of track to be temporarily disestablished is the sections of track within 20m of a water body.

For all other tracks, an assessment should be made as to whether they need to be temporarily disestablished so as to avoid a sediment discharge into a water body.

2.4 Disestablishment of Tracks

A track should be disestablished as soon as practical if no longer required for access to a harvest area by ground based or hauler harvest equipment. Disestablishment should be undertaken before machinery is moved to a new location.

Disestablishment of tracks is to include either:

1. Cut-outs that are installed to form a drain and a compacted earth bund on the downhill side of the drain. This bund should be of a sufficient height to avoid stormwater flowing over it; or

2. A swale drain and bund on the downhill side of the swale drain. This type of drain enables ongoing access on the track for fire or planting; and

3. The exit point of the cut-out is to be directed onto original ground and not placed through fill material. Preferably the outflow from the cut-out should be through slash to minimize sediment movement; or

4. Where the gradient of the track is not steep and the velocity of stormwater down the track will be low, then just slash may be placed over the entire surface of the track.

5. If slash can be deep (no soil visible underneath it) and compacted, it can be used on its own on steep slopes.

Obvious locations for cut-outs are track undulations or dips.

Where tracks are within 20m of a water body or in other sensitive locations, a combination of both cut-outs and slash should be employed. Cut-outs and slash should not be employed in the flood zone.

Extraction haul paths shall be sensibly managed to minimise soil disturbance.

Gradient	Grade %	Cut out spacing	
		Green, Yellow and Orange <25° zones	Orange >25° and all Red zones
1:20	5%	75m	50m
1:15	6.5%	60m	40m
1:12	8%	45m	30m
1:10	10%	35m	25m
1:08	12.5%	30m	20m
1:07	14%	22m	15m
1:06	16%	18m	12m
1:05	20%	15m	10m

Table 4: Cut-out spacing for forest track disestablishment

Example of use of cut-out spacings:

A 50m section of track that has a 20% gradient will require five cut-outs. The location of the cut-outs does not need to be precisely at 10m intervals and can vary to ensure that cut-out exit is not through fill and that stormwater discharge is over original ground.

2.5 Maintenance of Tracks

Tracking should be adequately maintained at all times to avoid or minimise erosion and sediment discharges to any adjacent water bodies.

Tracks in cut-over are difficult to access on an ongoing basis and access via heavy machinery can often destroy the rehabilitation works done. Plan robust rehabilitation works to reduce the risk of re-works prior to full stabilisation of the site. Often, deep and compacted slash, fully covering the disturbed areas, is the most robust form of rehabilitation. Where compacted slash is not used, post operational maintenance is critical for cut-outs and swale drains to keep working.

It is recommended to have a regular maintenance programme to ensure that erosion and sediment controls continue to function properly. In some instances, you may need to do ongoing maintenance until the cut-over/ establishment area is fully vegetated and stabilised. Inspect vulnerable areas before and after heavy rain is also advised.

3 WATER BODIES

3.1 River Crossings

Objective: To design and place a structure allowing for permanent access to cross a water body.

River Crossings are defined as a single culvert, battery culvert, drift deck, ford or single span bridge. Every permanent crossing of a water body within a forest must have a risk assessment carried out on it before construction.

You must have a plan for:

1. Pre-construction management (risk assessment and design appropriate to risk, taking into account timing, water flow, size of water body etc.);
2. Monitoring during construction
3. Monitoring post construction period; and
4. Monitoring of structure post storm event

Considerations when undertaking the crossing design include:

- Location; a crossing (even a temporary crossing) must NOT be constructed –
  - In a wetland larger than 0.25ha
  - In a wetland less than 0.25ha if the crossing extended more than 20m in length within the wetland
  - Within an outstanding water body (refer appendix 8)
  - Within a significant natural area (refer appendix 8)
  - Less than 500m upstream of a dwelling that is within 15m of a riverbed 3m or more wide
  - Downstream of a dwelling with a ground-floor level that is less than 1m above the highest part of the river crossing
- Catchment size
- Vegetative makeup of the catchment (cut-over, forest, native, pasture that will be present after harvest)
- Water body width
- Water body gradient
- Water body substrate
- Local climatic condition
- Harvest schedule (progress through percentage of total water catchment clear felled)
- Fish passage
- Designed spillways
- Headwall and outfall protection
- Available equipment and resources
- Overland flowpath, e.g. to ensure the safe passage of a 1-in-100 year period flood event.

Permanent crossings are a permitted activity if it adheres to the following:

- Allows fish passage both up and down stream
- Water run-off from roads must be diverted 10m before the river crossing
- Must not cause or induce erosion of the stream bed or instability of the banks of the water body
- Must not dam or alter the alignment/gradient of the river
- Culvert installation 20% invert

Construction advice:

- Prepare the stream bed for the pipe and allow for a crossfall of 2-4%. This is to allow consistent water flow.
- Armour either end of the culvert to provide stability to fill used in the crossing and structure for fish passage.
- Always provide structure for fish passage in the culvert. Options include:
  - Attaching steps inside the culvert
  - Using culvert baffles
  - Purchasing specifically designed culverts
  - Having stream bed material in the pipe (1/3 diameter of the culvert) – Not the best option for silty streams.
- Single culverts must be at least 450mm in diameter

Before installing the permanent crossing, you must:

- Carry out flow calculations to determine the appropriate culvert sizing. The culvert calculation method will depend on the size and shape of the catchment. Use the appropriate culvert calculation method from the New Zealand Forest Road Engineering Manual. Reference to the manual:

https://www.nzfoa.org.nz/images/NZ_Road_Engineering_Manual_Web_Feb_2020_compressed.pdf

- For single culvert crossing they must be designed to withstand a one in 20-year storm event or 5% AEP flood event without heading up.

Adequate headwall protection and culverts positioned to allow for fish passage. However, the height of the crossing exceeds 800mm and the culvert pipes are not inverted 100mm below the river bed level. This crossing is not compliant with NES-PF

This is NOT a good example of a culvert positioned to allow for fish passage. This is not compliant with the NES - PF

Culvert amouring

Compliant fish passage structure

3.2 Temporary Crossing

Objective: To design and place a structure allowing for temporary access to cross a water body that is fit for purpose.

Every temporary crossing of a water body within a forest must have an assessment carried out on it before construction.

Operational Considerations:

- A 300mm minimum sized culvert must be placed on the bed to ensure the free flow of water through the crossing.
- It's good practice to have a couple of large steel pipes available onsite if and when a crossing is needed.
- The location of the crossing should be agreed upon before installation to ensure the most effective and practical placement for the pipe.
- Look at the narrowest point in the waterbody to place the crossing to minimise disturbance.
- Temporary crossings should be used in gullies with minimal flow or in ephemeral flow paths to minimise soil disturbance as necessary.
- The culvert should be placed at the base of the stream bed if it has a rigid bottom. Silty stream beds may require a layer of corduroy before placing the culvert in the stream.
- Build the crossing up with logs to keep machines out of the stream. This helps minimise sediment discharge/disturbance of the water body and stops machine movement in the stream.
- Monitoring during the duration the crossing is in place is important to ensure there is no damming or sediment discharge.
- Temporary crossings cannot be in place for longer than 2 months. If it is required for a longer period, then it will need to be constructed as a permanent crossing under the NES - PF.
- The temporary crossing should be removed as soon as it is no longer required.
- Before a storm event, it is recommended to remove the temporary crossing to avoid failure.
- Before removing the crossing, install cut offs in the track leading to the crossing to prevent sediment and water run-off into the waterbody.

A well planned and constructed crossing. Crossing over wet ground with corduroy placed, then slash positioned over the top to bind the structure together.

Side profile of the crossing above

Earth slurry will overflow directly into water

Temporary crossing in a minor stream with minimal flow

3.3 Harvesting near Waterbodies

Objective: To fell and extract trees safely and without damage to the waterbody.

Considerations when harvesting next to waterbodies include:

- Full suspension must be achieved for hauling over waterbodies 3m or more in width. If this cannot practically be achieved, a resource consent should be applied for. Seek advice from NRC.

- Trees must be felled away from any waterway or riparian zone except where it is unsafe to do so or disturbance is likely to be minimal.

- Machinery must not operate within the following setbacks.

    - Within 5 meters from a perennial river with a bankfull channel width less than 3m or a wetland larger than 0.25ha

    - Within 10 meters from a perennial river with a bankfull channel width of 3m or more, a lake larger than 0.25ha, an outstanding freshwater body or a water body subject to a conservation order

- Harvesting machinery may be operated within the above setbacks if the disturbance to the water body is minimised and the machinery is being operated in the following circumstances:
    - At water body crossing points,
    - Where slash removal is necessary,
    - Where essential for directional felling and
    - Extraction of trees within the setbacks.

Tree planted close to waterbody. Trees have been felled back into the stand away from the waterbody

4 HARVESTING

To assist with harvest planning, the following examples are attached as Appendices to these Guidelines:

Appendix 12: Schedule 3 checklist
Appendix 13: Harvest Plan Map
Appendix 14: Slash management plan

ESC Zone		Thresholds for permitted activity
Green		PA, regulations 64-69 need to be met
Yellow		PA, regulations 64-69 need to be met
Orange	<25° Slope	PA, regulations 64-69 need to be met
	>25° Slope	PA, regulations 64-69 need to be met
Red		Not LUC8e, where it involves no more than 2ha of harvesting in any 3month period.
Harvesting where a minimum of 75% canopy cover is maintained at all times for any given hectares of plantation forest land is a permitted activity (PA) in all ESC zones if regulations 64-69 are complied with.		

Table 5: Harvesting thresholds for different ESC zones

4.1 Harvesting systems

4.1.1 Road Line Salvage

Objective: To achieve a corridor to optimise future construction and harvesting while recognising safety and environmental compliance requirements.

Road line salvage operations include the clearance of corridors to allow areas for subsequent roading and landing construction. Every road line salvage operation within a harvest area must be planned.

Considerations when undertaking road line salvage include:

- Timing of the year
- Soil type
- Topography
- Water bodies and area
- Engineering design
- Corridor width
- Placement of slash
- Available equipment and resources
- Archaeological and protected sites.

Refer section 2.1 – Formation of Tracks.

4.1.2 Ground Based Harvesting

Objective: To harvest an area efficiently while recognising safety and environmental compliance requirements.

Considerations when undertaking ground-based harvest include:

- Timing of operation (risk to catchment)
- Equipment type and technique
- Soil type
- Topography
- Water bodies (refer Slash in Water Bodies, section 4.2.1)
- Temporary crossing
- Placement of slash on landing
- Archaeological and protected sites
- Protected native areas
- Corduroy on haul tracks to control sediment mobilisation
- Flexibility to move within harvest area
- Tracking intensity (number of tracks and timing)
- Timely installation of cut-outs and slash, if needed, of tracks

A very well rehabilitated track. Slash from adjoining area pulled over track as the crew pulls out of the area.

Poorly managed haul track that has little or no water control. Photo taken from next to waterway where sediment flowed freely into.

4.1.3 Hauler Harvesting

Objective: To harvest an area efficiently while recognising safety and environmental compliance requirements.

Considerations to be taken into account when hauler harvesting include:

- Equipment type and inhaul technique or system.
- Soil type.
- Topography.
- Water bodies (refer Slash in Water Bodies, section 4.2.1).
- Low payload areas.
- Placement of slash on landing.
- Archaeological and protected sites.
- Protected native areas.
- Tracking requirements (refer section 2 – Tracking).

Considerations for minimisation of gouge lines which run directly into high-risk streams or their Riparian Management Zone includes but is not limited to:

1. Placement of hay bales in gouged lines pegged by warratahs.
2. Cut off water from gouge line at source catchment reduction.
3. Installing cut-outs in gouged lines.
4. Hay bales and/or silt fence in conjunction with hay.

NOTE: All remedial options need to be proactive and suitable to the size or volume of run-off.

Deep gouges across ridgeline due to poor deflection may require rehabilitating to minimise erosion, particularly where gouges run directly into a river.

Two stage hauler. Significant volume passed along this single corridor. Ensure good deflection on such sites to avoid excessive gouging. Steep gouged areas adjacent to waterways may require remedial works to avoid sediment discharge.

Deep gouging running directly up ridgeline. Review other hauler configurations, i.e. north bend bridle off the ridge edge, to avoid gouging on leading ridge edge.

4.1.3 Post-harvest decommissioning

Harvest areas should be decommissioned progressively, as soon as practical after infrastructure is no longer needed for the harvest.

Disestablishment of a harvesting site should include:

1. Rehabilitation of tracks (see 2.4).
   NOTE: When operating in high erosion risk areas (identified as orange or red zone under the NES) temporary tracking must be deactivated within 20 days of completing work in that area.
2. Removal of temporary crossings (see 3.2)
3. Review slash management plans and ensure they are actioned – mobilisation and river risks, birdsnests (see 4.2).
4. Ensure water and sediment controls along roads and on landings are open and working
   - Direct water off roads and landings and away from fill areas. If this is not practical water should be flumed over fill areas onto hard ground.
   - Fill areas should be stabilized.
   - Sediment controls should have capacity to work as intended.

A landing with a stream running along one side of it has been stabilised with the use of slash.

4.2 Slash

Definition of Slash:
*"*Any tree waste left behind after plantation forestry activities" – NES-PF

A slash management plan must be included in your harvest plan to avoid, remedy or mitigate slash from mobilising and creating an environmental risk.

The NES-PF specifies the following rules when managing slash:

- Slash from harvesting must not be deposited into a water body or onto the land that would be covered by water during a 5% AEP weather event.
- If slash is deposited into a waterbody (or land covered by a 5% AEP) it must be removed, unless it's not safe to do so to avoid:
    - Avoid blocking or damming of a water body
    - Avoid eroding river banks
    - Avoid adverse effects on aquatic life
    - Avoid damage to down stream infrastructure
- Slash should be left on stable ground
- Slash on the edge of landing sites must be managed to avoid the collapse of slash piles

Operational considerations

Slash management should be developed taking the following into account:

- Risk management.
- Slash storage zones
- No slash zones
- Removal of all potentially mobile slash (loose branches).
- The use of slash traps both natural (the use of large trees), or engineered structures (railway irons).
- The presence and leaving of wind throw.
- Removal of all slash.
- Removal frequency.
- Monitoring frequency (the higher the risk the more monitoring required).
- Harvest techniques.
- Stream classification.
- Catchment size.

An example of a Slash Management Plan/Checklist is attached as Appendix 13

4.2.1 Slash in Water Bodies

Objective: To minimise the opportunity for slash mobilisation off site and to mitigate adverse effects on sensitive water bodies.

Every water body within a harvest area must have a risk assessment undertaken as per Table 3: Slash Management Requirements (next page).

You must have a slash management plan for:

1. Managing slash pre harvest (i.e. prior to harvest demonstrate how slash will be managed during harvest).
2. Monitoring slash during harvest.
3. A plan to assess post harvest for remedial actions required; and
4. Monitoring slash post harvest.

Considerations when completing risk assessment include:

- Climate and likelihood of high intensity rainfall events.
- Surrounding topography and soil stability.
- Catchment size, permeability and likelihood of flooding.
- Proximity and importance of downstream infrastructure both internal and external to the forest, e.g. houses, fences, culverts, bridges, water intake structures etc.
- Water body ecological values – species present and their rarity (refer Appendices 10 and 11).
- Proximity of the site to neighbouring boundaries, state highways or public roads.
- Proximity of trees to the margin of the water body or on steep slopes above the water body.
- Evidence of historic or recent landslide activity.

After the catchment has been assessed for risk, a decision can then be made on how to manage slash around a water body in the harvest area. Consideration needs to be given and a decision made based on an environmental/economic cost benefit analysis when determining the most appropriate option, e.g. construction of access roads so as to pull trees away from a water body, rather than to pull trees across a water body and leaving slash behind.

The following techniques should be considered to minimise slash in water bodies and/or adverse offsite effect:

- Back pulling trees where practicable, (use of tethered machine).
- Corridor pulling through a water body using south bend or mechanised carriage systems.
- No trimming, or heading in or over a water body.
- Fell first row of edge trees across water body (to bridge valley floor) to provide bank protection of the water body.
- Leave high stumps adjacent to waterway to reduce sweeping of slash.
- Stable wood (i.e. windthrow) can be left in the water body.
- Slash traps may be used if this can be done without damming the river. Consideration should be given to all alternatives.

NOTE: Examples of stable woody material includes:

- Windthrown trees – both the presence of a rootwad and branches makes them extremely stable even in flood events.
- Long branches and stems at least longer than the channel bank full width – the longer they are in relation to channel width the more stable.
- Long branches and stems extending outside the channel, i.e. partially on the bank.
- Woody material that is partially buried.
- Full stems (with branches attached are even more stable).
- Large non-merchantable pieces of logging slash that bridge over the river, i.e. sitting over an incised channel with unrestricted waterflow underneath.

Table 3: Slash Management Requirements

(Note: Water Body Classification: Refer Appendix 8 – Stream Classification / Risk Rating Matrix)

Water Body Classification	Slash Removal Recommendations
Types 1, 2 & 3H	1. Plan operation to pull away from water body and avoid slash entry to water body. 2. Any logging slash entering the water body must be removed. 3. Windthrow to be left. 4. To be monitored daily and logging slash removed weekly.
3M, 3L & 4H	Develop documented slash management plan.
4M, 4L & 5H	Unless unsafe to do so, slash shall be removed where it will cause: a. Blocking or damming of a water body; b. Eroding river banks; c. Significant adverse effects on aquatic life d. Damaging downstream infrastructure, property, or receiving environmental, including the coastal enviro.
4L, 5M & 5L	Slash may be left in place.

Table 65: Slash management recommendations according to water body risk rating

In the event of a flood or mid slope failure where slash moves off site no matter what management practices have been employed, there is still an obligation on the foresters / land owner to do the right thing and assist with the clean up to a reasonable level.

Photo below shows slash cleaned out of water body with smaller woody debris left to stabilise stream banks

A large amount of slash is in the process of damming. Techniques suggested previously can reduce the potential damming.

Class 3 Stream

Too much slash left in a significantly sized waterway with high stream gradient can easily mobilise and create large debris dams that are all but impossible to remove. Streams of this size need to be evaluated as part of the slash management plan.

A larger example of the photo above

4.2.2 Slash on Landings (Birds Nests)

Objective: To ensure that the placement of waste wood does not compromise landing stability and/or piles of waste wood.

Slash risk assessment should be undertaken for all landings. You must have a plan for:

1. Managing slash pre harvest (i.e. prior to harvest demonstrate how slash will be managed during harvest).
2. Monitoring slash during harvest.
3. Ensure as much as possible merchantable wood is recovered (seek pulp market options)
4. A plan to assess post harvest for remedial actions required; and
5. Monitoring slash and landing stability post harvest.

The following practices should be considered to minimise the instability of bird nests:

- Placing of slash on formed benches (to be undertaken prior to commencement of harvest.
- If lack of storage for slash is identified at the site, trucking slash off site should be considered.
- Water controls:
  - Manage water away from fill faces; and
  - Control water outlets to original ground.
- Pull slash back from fill areas.
- Burning should take into account burning rules C.7.1 in the Proposed Regional Plan for Northland.

Slash management must be planned to prevent failure.

Slash pulled back and the landing edge bunded to direct water to sediment trap on stable ridge away from fill

Slash pulled back and placed on stable fill ground of landing. Note that stable slash to right of picture has been left *in situ.*

Partially burnt slash left on fill area resulting in landing slump. Significant volumes of fill mobilised with the slash.

Fill overtop of woody vegetation

A slumped landing as a result of slash left on fill areas combined with poor water control.

Example of a successful landing burn. A burnt landing site will still require adequate water control to protect fill slopes or slash to be pulled back.

A long-reach digger being used to pull slash back on to the landing

Overloaded landing

Slash mobilisation due to slope failure

Inappropriate slash storage area

4.3 Wetlands

Objective: To minimise the amount of disturbance to wetlands while tailoring forestry operations to the wetland type to aid in quick recovery.

Work in and around wetlands are regulated through the NES-PF. These guidelines provide information on best practice harvesting techniques in and around wetlands.

NRC Regional Plan provides further information on the types of wetlands and their sensitivity to disturbance. NRC can also provide guidance on protecting or enhancing wetlands.

When planning your earthworks and harvest it is important to recognise and identify any wetlands in your work area. It is important to understand the type of wetland you have in your operation so you can determine the best practice earthworks and harvesting techniques. Table 7 can assist you with identifying the type of wetland and Table 8 can help with harvesting techniques.

4.3.1 Working around a Wetland

When working around a wetland all efforts should be made to machine assist fell away from the wetland where practicable. If this is not practicable and trees need to be felled into the wetland, discussions should occur with NRC to determine if these trees can be recovered or are better left felled in the wetland. This will be determined by the type of wetland you are working around.

NES –PF setback rules do apply to working around wetlands, this includes machinery (harvesting and earthworks) setback rules.

ACTIVITY	WETLAND	SETBACK
Earthworks	Larger than 0.25ha	Machinery 5m
River crossing	Larger than 0.25ha Or 0.25ha or less where the river crossing extends over more than 20m in length	Not to be constructed in wetlands
Harvesting	Larger than 0.25ha	Machinery 5m
Fuel storage and refuelling		Located 10m from wetland

Table 7: Wetland setbacks for forestry activities

4.3.2 Disturbing a Wetland during Harvesting

Where it is necessary to disturb a wetland by pulling across or through a wetland, the Fish Spawning Indicator should be used to determine the presence or no presence of Northland mudfish. If Northland mudfish are present no disturbance to a wetland may occur during the Northland mudfish spawning season, (1 April to 30 September).

Using Table 7, determine the type of wetland within your harvest area and then look at best practice harvesting techniques in Table 8. It is also advised to write these practices up as part of your harvest plan and submit this when giving notice to Northland Regional Council.

Peat wetlands (substrates an accumulation of partially decomposed plant material)		
Swamp	Some peat, fertile, moderate water flow, valley floors and basins. Most common wetland type. Raupo, reeds, rushes, tussock sedges (Carex, Cyperus), swamp millet grass, bindweeds, cabbage trees, flax, shrubs.	Not Sensitive
Bog	All peat, not fed by run-off, infertile, acidic. Level ground from ridges to basins. Rush–like sedges, sphagnum, sundews, wire rush, dracophyllum, manuka. Can be small. Often in Far North. **Rare**	Sensitive
Fen	Peat, fed partly by run-off, wet with surface water flow, more fertile than bogs, acidic. Occur on slight slopes. The **rarest** wetland type in Northland. Manuka, rush–like sedges, wire rush possibly with areas of swamp – raupo, flax, cabbage trees etc. Often very diverse at ecotones.	Sensitive
Wetlands without peat (substrates mineral or inorganic)		
Gumland	Poor drainage, dry out, not fed by run-off, ultra-infertile, acidic. Often ridge crests on hard podzols, white silica clay pan. Fires a feature. Short manuka, dracophyllum, rush–like sedges (Baumea, orchids, Schoenus, sword sedge), wire rush, tangle fern (Gleichenia). **Rare**	Sensitive
Marsh	Good drainage, but experience flooding, slight slopes, moderately fertile, not acidic. Valley bottoms associated with rivers and lakes. Uncommon as most have been cleared. Rushes, sedges, flax, cabbage trees, shrubs and trees.	Not Sensitive
Saltmarsh	Tidal and/or salt influence. Fertile. Sea rush, jointed rush (oioi), *Baumea juncea*, saltmarsh ribbonwood, herbfield, mangroves with manuka, flax, shrubland on edges. Can be diverse.	Sensitive
Seepage and flush	Hill slopes where groundwater comes to surface, moderately fertile. Small seepages common on farmland. Short rushes, sedges and herbfield.	Not Sensitive

Table 8: Wetland type and sensitivity to disturbance

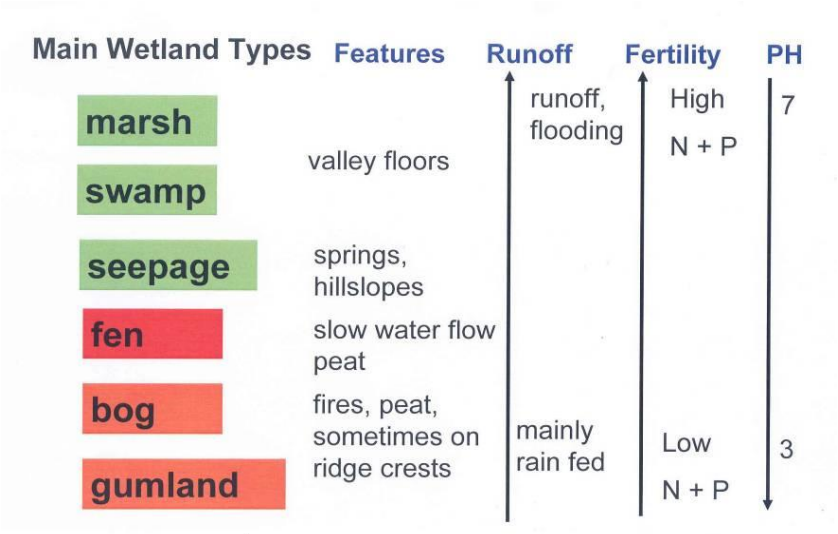
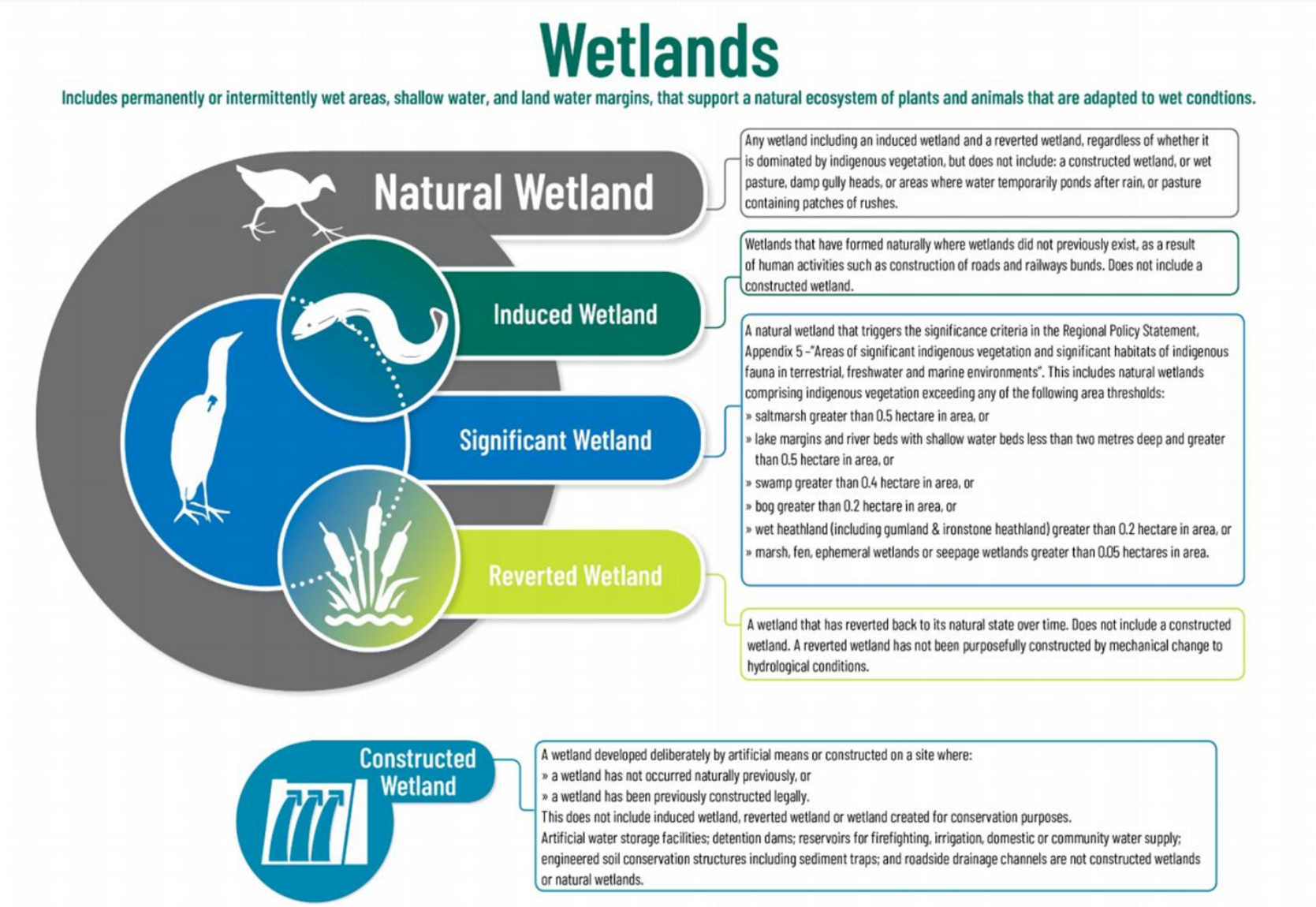


Figure 2: Wetland types and characteristics

<table>
<tr><th>Harvest Type</th><th colspan="2">Action</th></tr>
<tr><td rowspan="4">Ground based</td><td colspan="2">Machines used for ground based harvesting shall not operate within 5m of an indigenous wetland. Plan operations to avoid pulling through wetlands.</td></tr>
<tr><td colspan="2">Where practicable and safe, all trees shall be directionally felled or pulled back from an indigenous wetland.</td></tr>
<tr><td colspan="2">Where a tree has entered an indigenous wetland, it may be more appropriate to leave it in place rather than to remove the tree if doing so will cause excessive damage.
Another option to be considered is the removal of all limbs and extraction directly down the corridor in which the tree fell.
No trees are to enter a bog, fen, gumland or salt marsh.</td></tr>
<tr><td colspan="2">Where it is not possible to stay 5m from a wetland, a suitable haul corridor on drier ground should be identified and operations planned for summer. Consult with NRC regarding this option.</td></tr>
<tr><td rowspan="9">Hauler operations</td><td colspan="2">Where it is necessary to pull through an indigenous wetland the following guidelines should be followed:</td></tr>
<tr><td>Determine the type of wetland</td><td>Action</td></tr>
<tr><td>Swamp, marsh, seepage / flush</td><td>Can be pulled through with a hauler</td></tr>
<tr><td>Bog, fen, gumland or salt marsh</td><td>Avoid</td></tr>
<tr><td colspan="2">Haul lines shall not cause any change to the seasonal or annual range in water level of the wetland to the extent that would adversely affect the natural eco system of the wetland.</td></tr>
<tr><td colspan="2">An assessment of the wetland for mud fish is required using the Fish Spawning Indicator (NES-PF tool which can be found on NRC website). No disturbance to the wetland during fish spawning period.</td></tr>
<tr><td colspan="2">Select either: Haul corridors which concentrate damage to the pre-determined haul corridors (suitable for wetlands with woody vegetation);</td></tr>
<tr><td colspan="2">or</td></tr>
<tr><td colspan="2">Pull across the entire wetland to minimise any gouging by the haul lines (suitable for wetlands with non-woody vegetation, i.e. Raupo).</td></tr>
<tr><td colspan="2">At all times the butts of the logs are to be suspended above the ground.</td></tr>
<tr><td colspan="2">Monitoring should be put in place while operating within the wetland. Monitoring could include water table depth, gouging within haul corridors etc.</td></tr>
<tr><td colspan="3">Consider the benefits of wider riparian setbacks when replanting around wetlands.</td></tr>
</table>

Table 96: Harvesting considerations around wetlands

Figure 3: Wetland types



APPENDIX 1: DEFINITIONS

The following are a list of terms used throughout the document and their intended definition.

bankfull channel width means the distance across a river channel formed by the dominant channel-forming flow with a recurrence interval seldom outside a 1 to 2-year range (measured at a right angle to the channel flow)

batters means constructed slopes of uniform gradient

battery culvert means a river crossing structure made by using multiple culverts that allows the free flow of water in low flow conditions and high flows and debris to flow over the top of the entire structure

butt suspension means suspending the sawn base of the tree being harvested above the ground or surface of a water body while pulling it to a landing

compaction means applying pressure or vibration to soil or aggregate to strengthen it

culvert means—

> (a) a pipe or box structure that conveys a stormwater flow under a forestry road or forestry track; or
>
> (b) the entire structure used to channel a water body under a forestry road or forestry track

cuts includes side cuts and batters

drift deck means a river crossing structure composed of a series of inverted U-shaped precast concrete elements that is designed to pass low flows through the structure and allow high flows and debris to flow over the top of the entire structure

dwelling has the same meaning as that given for dwellinghouse in section 2(1) of the Act

earthworks—

> (a) means disturbance of the surface of the land by the movement, deposition, or removal of earth (or any other matter constituting the land, such as soil, clay, sand, or rock) in relation to plantation forestry; and
>
> (b) includes the construction of forestry roads, forestry tracks, landings and river crossing approaches, cut and fill operations, maintenance and upgrade of existing earthworks, and forestry road widening and realignment; but
>
> (c) does not include soil disturbance by machinery passes, forestry quarrying, or mechanical land preparation

end-haul means to remove excavated material to a disposal area

erosion susceptibility classification means the system that determines the risk of erosion on land across New Zealand based on environmental characteristics, including rock type and slope, and that—

> (a) classifies land into the following 4 categories of erosion susceptibility according to level of risk: low (green), moderate (yellow), high (orange), and very high (red); and

(b) is provided in the electronic tool referred to in item 1 of Schedule 2 (http://www.mpi.govt.nz/growing-and-producing/forestry/overview/national-environmental-standards-for-plantation-forestry/erosion-susceptibility-classification/)

existing river crossing—

(a) means a river crossing that was operational and able to be used at the commencement of these regulations; and

(b) includes a river crossing described in paragraph (a) that is used and maintained; but

(c) does not include a river crossing—

(i) that is described in paragraph (a) that is upgraded, removed, or replaced in accordance with these regulations; or

(ii) that is a ford or a temporary river crossing

fill means soil or aggregate, placed to raise the land surface, normally under a strict compaction regime

fish spawning means the bearing of live spawn or the deposit of eggs by fish

ford means a hard surface on the bed of a river (that is permanently or frequently overtopped by water) that allows the crossing of a river by machinery or vehicles

forestry infrastructure means structures and facilities that are required for the operation of the forest, including forestry roads, forestry tracks, river crossings, landings, fire breaks, stormwater and sediment control structures, and water run-off controls

forestry road—

(a) means a road that has the width, grade, strength, and pavement surface that allows a fully laden logging truck to safely traverse it and has all-weather access; but

(b) does not include a road managed by a local authority, the Department of Conservation, or the New Zealand Transport Agency

forestry track—

(a) means a track that allows the passage of forestry machinery or vehicles, but does not provide the width, grade, strength, or pavement surface to allow a fully laden logging truck to safely traverse it or lacks all-weather access; but

(b) does not include a track managed by a local authority, the Department of Conservation, or the New Zealand Transport Agency

harvesting—

(a) means felling trees, extracting trees, thinning tree stems and extraction for sale or use (production thinning), processing trees into logs, or loading logs onto trucks for delivery to processing plants; but

(b) does not include—

(i) milling activities or processing of timber; or

(ii) clearance of vegetation that is not plantation forest trees

heading up means a hydraulic head of water above the culvert inlet at times when the culvert's nominal capacity is exceeded

indigenous vegetation means vegetation that is predominantly vegetation that occurs naturally in New Zealand or that arrived in New Zealand without human assistance

landing means an area of land where logs or tree lengths extracted from a plantation forest are accumulated, processed, and loaded for removal

maintenance and upgrade of existing earthworks—

(a) includes—

(i) activities to upgrade existing forestry infrastructure or minor reshaping of existing forestry infrastructure; and

(ii) the installation and maintenance of water run-off control measures; and

(iii) road metalling; but

(b) does not include forestry road widening or realignment

outstanding freshwater body means a freshwater body that—

(a) is identified in a regional policy statement or regional plan as having outstanding values, including any ecological, landscape, recreational, or spiritual values, however described; and

(b) is identified in the policy statement or plan by its location, including by a map, a schedule, or a description of the area

outstanding natural features and landscapes means natural landscapes and features that—

(a) are identified in a regional policy statement, regional plan, or district plan as outstanding, however described; and

(b) are identified in the policy statement or plan by their location, including by a map, a schedule, or a description of the area

overburden means the overlying soil and rock that is removed to allow quarrying of the underlying material

perennial river means a river that is a continually or intermittently flowing body of freshwater, if the intermittent flows provide habitats for the continuation of the aquatic ecosystem

plantation forest or **plantation forestry** means a forest deliberately established for commercial purposes, being—

(a) at least 1 ha of continuous forest cover of forest species that has been planted and has or will be harvested or replanted; and

(b) includes all associated forestry infrastructure; but

(c) does not include—

(i) a shelter belt of forest species, where the tree crown cover has, or is likely to have, an average width of less than 30 m; or

(ii) forest species in urban areas; or

(iii) nurseries and seed orchards; or

(iv) trees grown for fruit or nuts; or

(v) long-term ecological restoration planting of forest species; or

(vi) willows and poplars space planted for soil conservation purposes

plantation forestry activity means any activity regulated under subparts 1 to 9 of Part 2 of these regulations that is conducted in plantation forestry

replanting means the planting and growing of plantation forestry trees on land less than 5 years after plantation forestry harvesting has occurred

riparian zone means that margin and bank of a water body, including the area where direct interaction occurs between land and water systems, that is important for the management of water quality and ecological values

river crossing—

(a) means a structure that is required for the operation of a plantation forest and provides for vehicles or machinery to cross over a water body; and

(b) includes an apron and other structures and materials necessary to complete a river crossing; but

(c) does not include a stormwater culvert or a culvert under a forestry road or forestry track

salvage operation means the urgent extraction of trees that have been damaged by fire or wind throw

sediment means solid material that—

(a) is mineral or is mineral and organic; and

(b) is in suspension, is being transported, or has been moved from the site of origin by air, water, gravity, or ice and has come to rest on the earth's surface, either above or below water

sediment control measures means structures or measures to slow or stop water with sediment in it, so that the sediment will drop out of suspension before the water from the site reaches a water body

setback means the distance measured horizontally from a feature or boundary that creates a buffer within which certain activities cannot take place

side cast means placing non-compacted fill or spoil that has been excavated from a cut to create forestry infrastructure on the downhill slope from the infrastructure

side cut means the excavation of an uphill slope that is required to create forestry infrastructure

significant natural area means an area of significant indigenous vegetation or significant habitat of indigenous fauna that—

(a) is identified in a regional policy statement or a regional or district plan as significant, however described; and

(b) is identified in the policy statement or plan, including by a map, a schedule, or a description of the area or by using significance criteria

single culvert means a river crossing structure made by using 1 culvert to carry the water flow and creating a surface on top of the culvert to cross a water body

slash means any tree waste left behind after plantation forestry activities

slash trap means a structure set in a river, on the bed of a river, or on land to trap slash mobilised by water

spoil means the by-product of excavations and earthworks

stormwater control measures means structures or measures to manage stormwater on formed surfaces, to reduce the volume or velocity of water run-off so as to reduce its power to entrain sediment

stormwater culvert means the culvert below the road profile that cross-drains water from the stormwater drain (the water table) at the inner edge of a forestry road or forestry track to its outer edge

temporary river crossing—

(a) means a river crossing that is in place for up to 2 months; and

(b) includes a corduroy, which is a structure made by laying a culvert in the bed of a river to carry the water flow and creating a running surface approach using logs placed parallel to the culvert; but

(c) does not include a bridge or ford

water run-off control measures means structures or measures to reduce the volume or velocity of water run-off and consequently reduce its power to entrain sediment

APPENDIX 2: GENERAL RESOURCE CONSENT FLOWCHART

Use the following flow chart as a general guide to establish if an activity is permitted or requires a consent, then use the subpart flow charts in appendices 3 - 5 for more detail on the consenting regulations for each subpart.

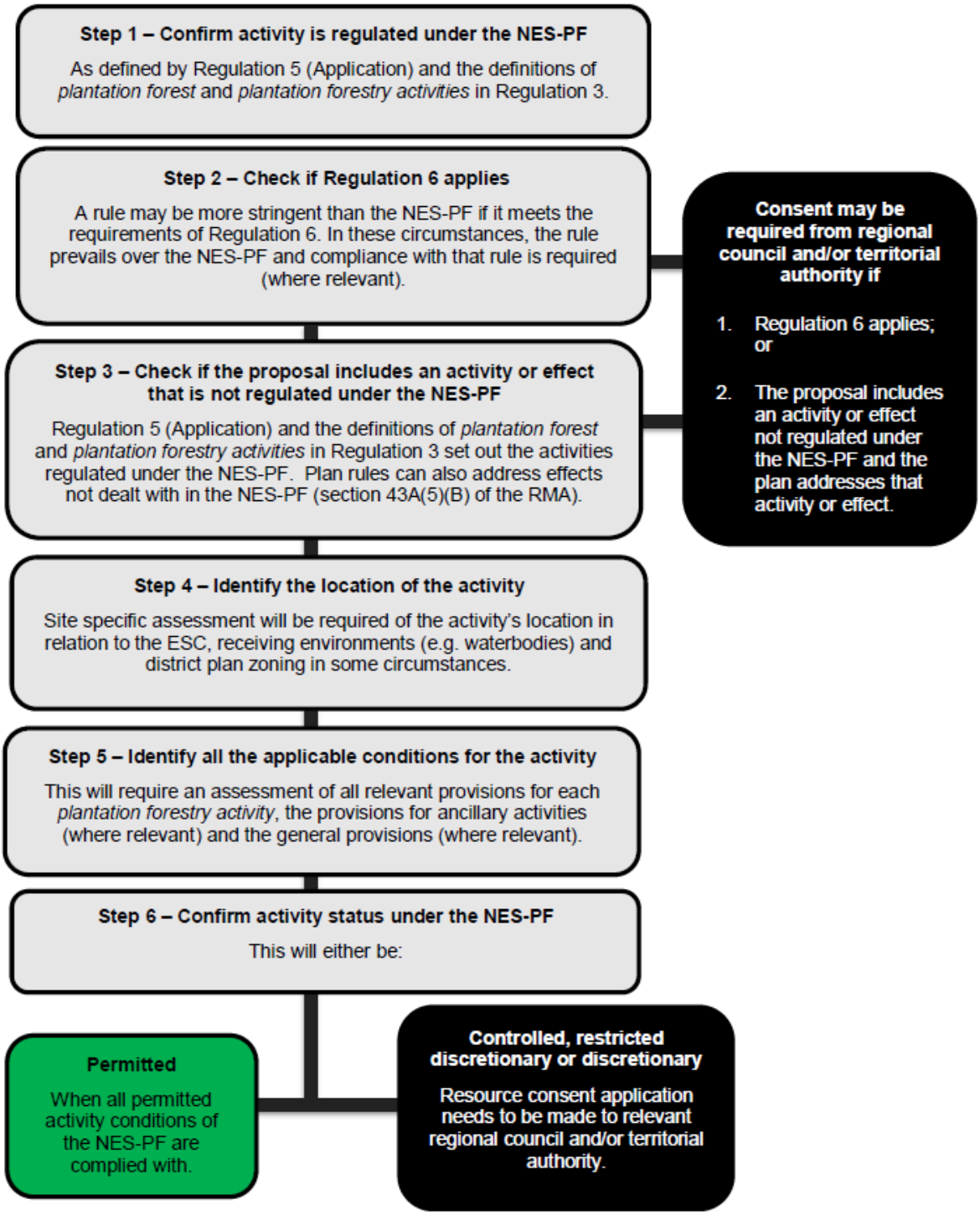


Figure 4: Steps to determine whether a plantation forestry activity complies with the NES – PF or requires a resource consent. (source: Resource Management (NES-PF) Regulations 2017 – User Guide, 2018)

ADDENDIX 3: EARTHWORKS CONSENT FLOWCHAT

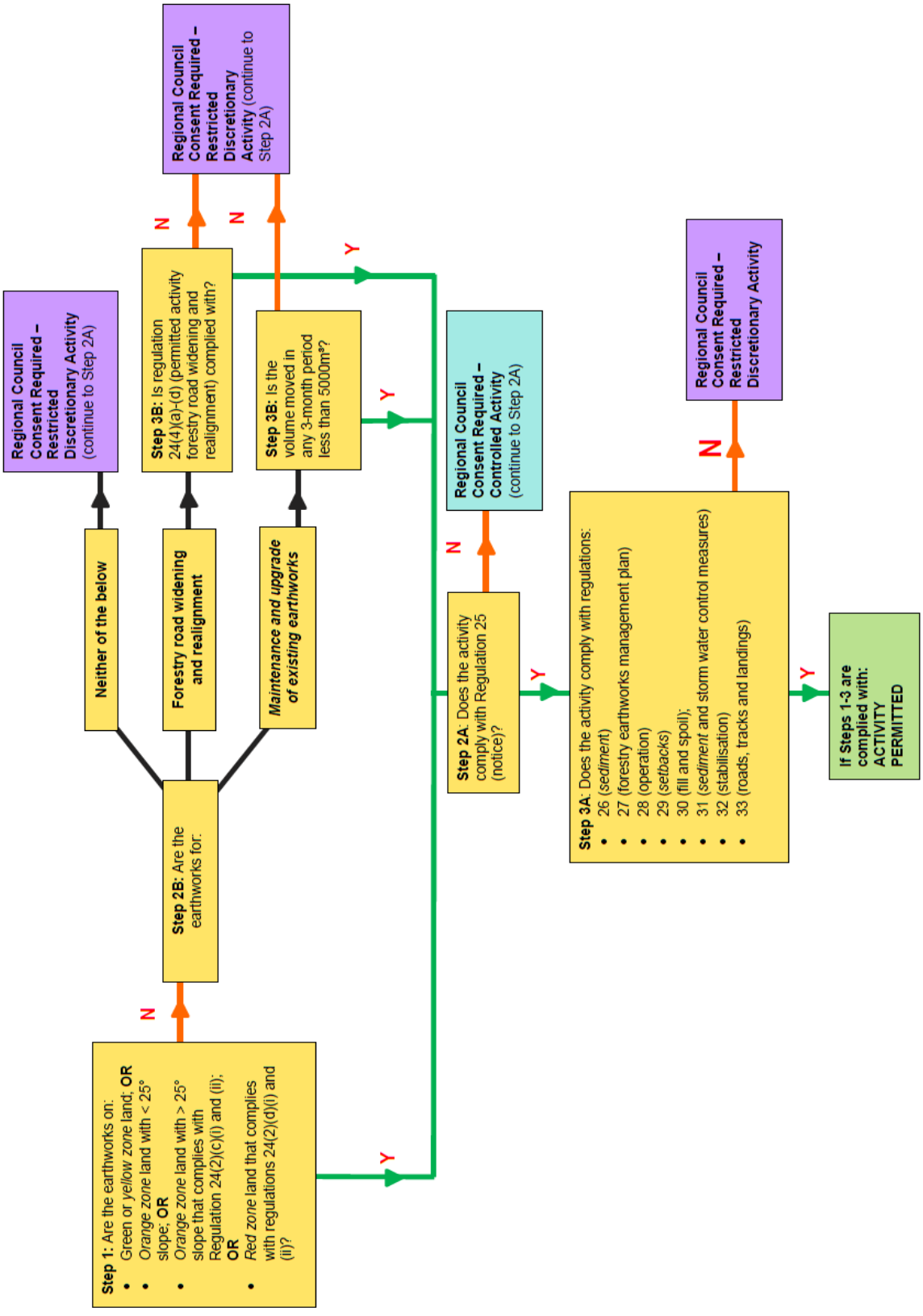


Figure 5: Flow chart to determine whether a consent is required for earthworks. (source: Resource Management (NES-PF) Regulations 2017 – User Guide, 2018)

APPENDIX 4: RIVER CROSSING CONSENT FLOWCHART

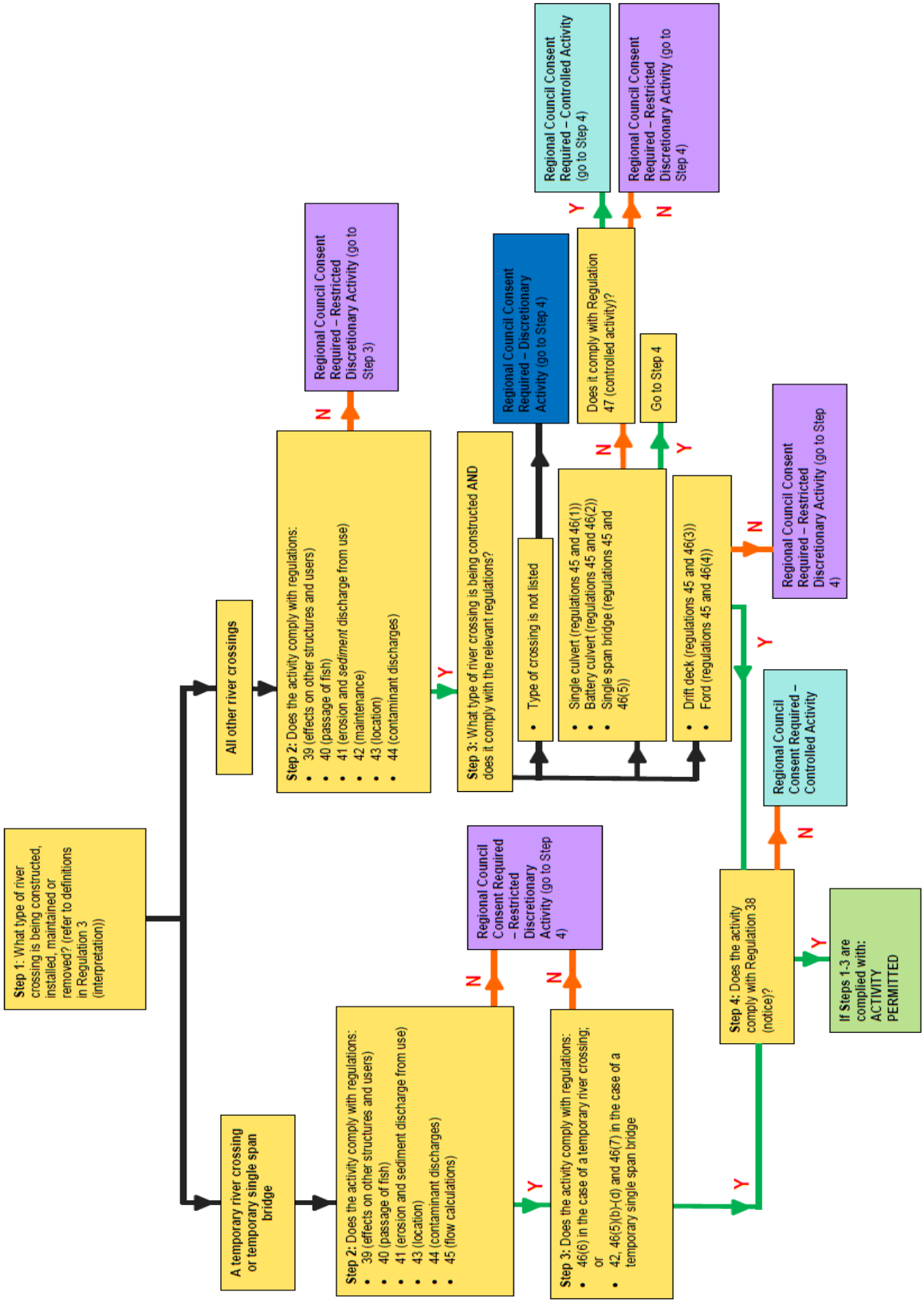


Figure 6: Flow chart to determine whether a consent is required for river crossings. (source: Resource Management (NES-PF) Regulations 2017 – User Guide, 2018)

Figure

APPENDIX 5: HARVESTING CONSENT FLOWCHART

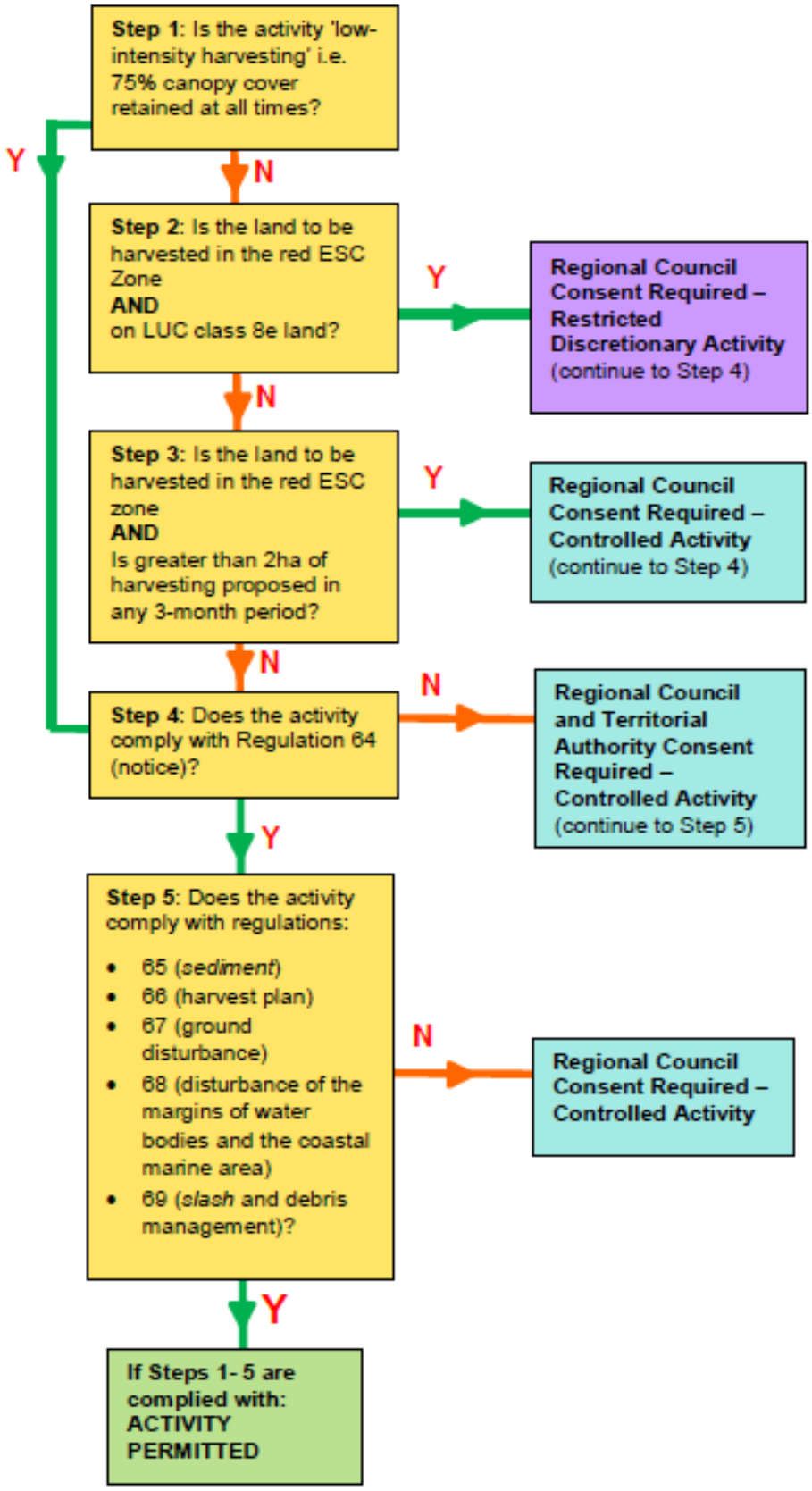


Figure 7: Flow chart to determine whether a consent is required for harvesting. (source: Resource Management (NES-PF) Regulations 2017 – User Guide, 2018)

APPENDIX 6: EROSION SUSCEPTABILITY CLASSIFICATION (ESC)

A key component of the NES-PF is the ESC. To develop the ESC, all land in New Zealand was assessed to determine its erosion risk for *plantation forestry* as a basis for applying appropriate levels of control, including requiring resource consent to be obtained for certain *plantation forestry activities* on high or very high-risk ESC land.

All land in mainland New Zealand (excluding areas that have been severely modified – e.g. urban towns, quarries) have been classified as one of four ESC zones. Land zoned green (low) and yellow (moderate) has lower erosion risk and *plantation forestry activities* are permitted on this land, provided other relevant conditions are complied with. Land zoned *orange zone* (high) and *red zone* (very high) has higher levels of erosion risk.

ESC Zone	***Green zone***	***Yellow zone***	***Orange zone***	***Red zone***
Risk rating	Low risk	Moderate risk	High risk	Very high risk
Consent requirement	N/A	N/A	*Earthworks* (on a slope of 25 degrees or more and that exceed the thresholds in Regulation 24(2)(c)) *Forestry quarrying* (in *earthflow terrain*) *Mechanical land preparation* (where the land slope is 25 degrees or more, the subsoil is affected, and the area covered by the mechanical land preparation activity is greater than 2 ha in a calendar year)[12]	*Afforestation* (where the land proposed for *afforestation* is greater than 2 ha in any calendar year) *Earthworks* (that exceed the thresholds in Regulation 24(2)(d))[13] *Forestry quarrying* *Harvesting* (where the land is *Land Use Capability Class 8e* and it involves more than 2ha of *harvesting* in any 3-month period) *Mechanical land preparation* (where the land slope is 25 degrees or more, the subsoil is affected, and the area covered by the mechanical land preparation activity is greater than 2 ha in a calendar year) *Replanting* (where the land proposed for *replanting* is greater than 2 ha in any calendar year)

Table 7: ESC zones and resource consent requirements under the NES – PF (source: Resource Management (NES-PF) Regulations 2017 – User Guide, 2018)

APPENDIX 7: FISH SPAWNING INDICATOR

The Fish Spawning Indicator is used to manage the timing of plantation forestry activities that involve disturbance of the bed of a river or a lake, or a wetland in fish spawning locations. Spawning periods vary depending on the fish species and its location. The Fish Spawning Indicator is a tool to help foresters plan forestry operations by showing where and when fish that are sensitive to bed disturbance are spawning.

The Fish Spawning Indicator forms a key part of the permitted activity conditions for Regulation 97 – discharges, disturbances and diversions. It is to be used in all situations where a plantation forestry activity will involve the disturbance of the bed (or vegetation in the bed) of a perennial river or lake, or disturbance of a wetland.

The Fish Spawning Indicator groups fish species and their spawning periods into two sensitivity classes:

- **Group A** – salmonids or species with a conservation status of 'threatened' or 'at risk';
- **Group B** – species with a higher sensitivity to disturbance.

When the fish spawning indicator reveals the presence of fish species that may not present in reality, a *suitably competent person* must confirm that the species indicated in the Fish Spawning Indicator are actually not present in the segment of river/lake where the disturbance will occur.

The Fish Spawning Indicator webpage on the MPI website provides more information on how to use the indicator.

Group A		**Group B**	
-Redfin Bully	1 August to 31 October	-Northland mudfish	1 April to 30 September
-Koaro (sea run)	1 April to 30 June	-Black mudfish	1 April to 30 September
-Koaro (landlocked)	1 November to 30 January	-Dune lakes galaxias *(Waikere, Taharoa and Kai Iwi dune lakes)*	1 May to 30 August
-Giant Kokopu (sea run)	15 April to 15 July		
-Giant Kokopu (landlocked)	1 May to 31 August		
-Shortjaw Kokopu	1 May to 30 June		
-Banded Kokopu	1 May to 30 June		
-Brown trout	15 May to 15 September		
-Chinook salmon	1 April to 31 September		
-Rainbow trout	1 July to 30 November		

Table 8: Group A and Group B species present in Northland and their spawning periods.

APPENDIX 8: STREAM CLASSIFICATION / RISK RATING MATRIX

Stream Types				
1	**2**	**3**	**4**	**5**
Perennial	Perennial	Perennial	Perennial	Ephemeral / Intermittently Flowing River
>20m wide	7 – 20m wide	3 – 7m wide	Generally <3m wide	<1m wide
NRC Permanent Flowing Stream	NRC Permanent Flowing Stream	NRC Permanent Flowing Stream	NRC Intermittent Stream & Permanent Flowing Stream	
	>1,000 l/s	Approx. 100 – 1,000 l/s	<100 l/s	
		2nd Order named on NZMS 260 Series Maps	1st / 2nd Order	1st Order
High recreational use	Recreational use (possible canoeing, small boats etc.)	Minor recreational use	Too small for recreational use	No recreational use
High landscape value	Generally have native fish / fish spawning	Native fish habitat	Native fish habitat	No permanent native fish habitat
Note: Stream widths are to be calculated on the stream's average width of flowing water within the channel.				

Table 9: Stream types

Stream Risk Rating			
High	**Medium**	**Low**	**Consider**
High risk to downstream infrastructure	Some risk to downstream infrastructure	Low risk to downstream infrastructure or none present	Culverts, roads, bridges, canals, water supplies, irrigation
High ecological values present (hochstetter frog, native fish)	Moderate ecological values present	Low ecological values present (ephemeral minimal habitat)	Riparian margin, aquatic life, water quality
Water take for household consumption within 500m of the same stream type. NB: Applies to Types 3 & 4 water bodies only			
Water bodies of national importance.	**Note: Type 1 & Type 2 water bodies are always HIGH risk. Refer to Appendix 11 – Outstanding Value Rivers and Lakes from RWSPN.**		

Table 10: Stream risk rating

APPENDIX 9: SETBACKS

Setbacks are included in the NES-PF for afforestation, earthworks, forestry quarrying, mechanical land preparation and replanting, and for fuel storage and refuelling in the general provisions. These setbacks primarily relate to the distance from plantation forestry activities to different types of water bodies – including perennial rivers, lakes, wetlands, outstanding freshwater bodies, water bodies subject to Water Conservation Orders, and the coastal marine area.

Perennial rivers

The NES-PF includes different setbacks from perennial rivers with a bankfull channel width of less than 3m and perennial rivers with a bankfull channel width of 3m or more. The following NES-PF definitions in Regulation 3 are important when considering and measuring setbacks to perennial rivers:

bankfull channel width *means the distance across a river channel formed by the dominant channel-forming flow with a recurrence interval seldom outside a 1 to 2-year range (measured at a right angle to the channel flow)*

perennial river *means a river that is a continually or intermittently flowing body of freshwater, if the intermittent flows provide habitat for the continuation of the aquatic ecosystem.*

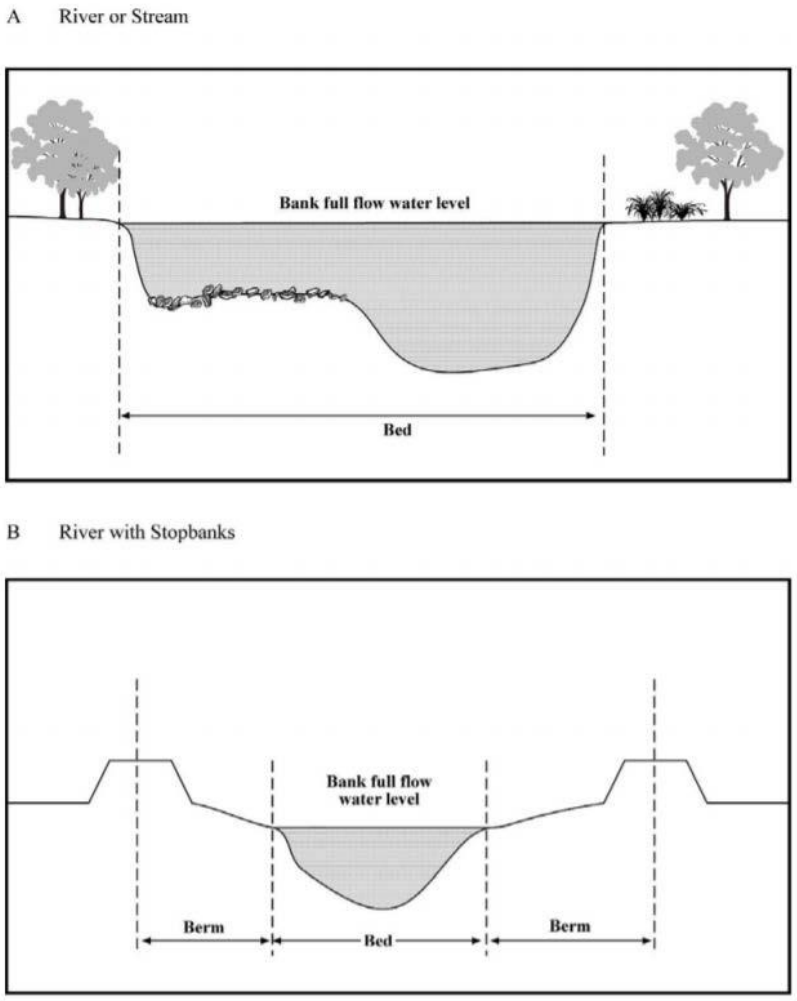


Figure 8: Bankfull channel width measurement examples (source: Resource Management (NES-PF) Regulations 2017 – User Guide, 2018)

Lakes

The term 'lake' is not defined in the NES-PF. However, it is defined in the RMA as '*a body of fresh water which is entirely or nearly surrounded by land'*. The water levels in lakes may fluctuate seasonally, but the boundary of the lake should be measured from the water high point on the lake's shore or bank.

Wetlands

The definition of *wetland* in the NES-PF is the same as the RMA definition of *wetlands* – '*includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions'.* Often the edges of *wetlands* are harder to define than other waterbodies as their boundary can respond significantly to changes in rainfall throughout the year and include intermittent wet areas.

Outstanding freshwater bodies

outstanding freshwater body *means a freshwater body that -*

(a) is identified in a regional policy statement or regional plan as having outstanding values, including any ecological, landscape, recreational, or spiritual values, however described; and

(b) is identified in the policy statement or plan by its location, including by a map, a schedule, or a description of the area.

Outstanding rivers in Northland	Outstanding lakes in Northland (including dune lakes)
• Waipoua • Waikohatu • Wairau • Whirinaki • Waipapa • Mangamuka	• Te Werahi Lagoon • Te Paki dune • Te Kahika • Waipareru • Ngakapua • Rotorua • Karaka • Kahuperere • Rotokawau (Pouto) • Morehurehu • Ngatu • Waihopo • Waiporohita • Wahakari • Taharoa • Waikare • Kai – Iwi • Humuhumu • Kanono • Mokeno

Table 11: Outstanding waterbodies in Northland identified in the Proposed Regional Plan and the Regional Policy Statement for Northland.

Water bodies subject to Water Conservation Orders

There are no water bodies subject to a conservation order in Northland at the time of writing.

Significant natural area

The significant natural area setback should generally be measured from the boundary of the significant natural area as defined in the relevant plan or regional statement to the closest edge of the plantation forest.

The significant natural areas as identified in the Regional Policy Statement for Northland are categorised into the following:

- Outstanding Natural Landscapes
- Outstanding Natural Features
- Outstanding Natural Character
- High Natural Character

Outstanding natural landscapes are assessed and identified using a number of criteria established in case law. These include: Geology, topography, ecology and associated formative processes; Aesthetic, visual, natural or wilderness values; Cultural, spiritual or historic associations; and Memorability, legibility and expressiveness.

Outstanding natural features has been informed by the use of the Geopreservation Inventory (Geological Society: 1995). This inventory provides a list of unique geological landforms and features, such as fossil beds, limestone outcrops, volcanic cones and unusual sediments.

Outstanding natural character generally means entirely natural (such as near to pristine indigenous land cover, negligible human features e.g. buildings, structures, paved surfaces, roading or vehicle tracks) and a very strong experience of naturalness.

High natural character generally means a high proportion of indigenous vegetation cover, visually unobtrusive land management (e.g. low intensity pasture), few and visually subservient human features and a strong experience of naturalness.

The Regional Policy Statement map of these significant natural areas can be found using this link:
https://localmaps.nrc.govt.nz/localmapsviewer/?map=f75ef7386f8f49d5bf4b0b89305d48e7

APPENDIX 10: ANNUAL EXCEEDENCE PROBABILITY (AEP)

Annual Exceedance Probability (AEP) is used in a number of NES-PF regulations, such as:

- The condition for *pruning and thinning to waste* requiring *slash* to be removed from certain areas (Regulation 20(2))
- The design of single culvert *river crossings* (Regulation 46(1))
- *Slash* management during *harvesting* (Regulation 69(3)).

AEP is defined in the NES-PF as follows:

'means the annual exceedance probability, which is the chance of a flood of a given size (or larger) occurring in any one year, usually expressed as a percentage'

The AEP's expressed in the NES-PF are either as a 2% or 5% threshold (depending on the regulation). AEP is the inverse of event frequency, so essentially represents a "one in fifty" or "one in twenty" year event. AEP is used to:

- Calculate an area of land that may be under water during a flood. This will generally be on a proxy basis, based on the observed levels of previous flood damage.
- Determine the size of a rainfall event, which will be assessed from rainfall records coupled with statistical analysis of intensity and duration to calculate event size.
- Estimate flood flows which are required for the design of all *river crossings*, except *fords*, under Regulation 45 using one of the methods referred to in items 3, 4 and 5 of Schedule 2 (Regulation 45).

To calculate AEP, the National Institute of Water and Atmosphere (NIWA) provides an on-line tool: High Intensity Rainfall Design System (HIRDS). HIRDS offers landowners, planners and engineers more certainty about the frequency of high-intensity rainfalls, enabling them to better design stormwater drainage systems and other structures. The web-based programme can estimate rainfall frequency at any point in New Zealand and can estimate rainfall depths for different *AEP* events. The HIRDS tool can be found at the following webpage: https://hirds.niwa.co.nz/

APPENDIX 11: INDIGENOUS BIRD NESTING

Plantation forests can provide a habitat to a number of threatened and valued indigenous bird species. Many forest owners have voluntary measures in place to protect these species, such as predator control and avoidance of operations at known nesting sites. However, these species can be adversely affected where their presence is not known and/or where appropriate procedures are not in place to identify and protect them.

Regulation 102(1) states that the procedures in Regulation 102(2) must be complied with where a *plantation forestry activity* occurs where the following indigenous bird species are nesting:

> • Any indigenous bird species with a classification of Nationally Critical, Nationally Endangered, or Nationally Vulnerable in Conservation Status of New Zealand Birds

National Critical	Nationally Vulnerable	Nationally endangered
Australasian Bittern Grey duck NZ fairy tern White heron	Banded dotterel Caspian tern Kaka	Reef heron

Table 12: Relevant Northland indigenous bird species and their conservation status.

> • North Island brown kiwi (*Apteryx mantelli*)
>
> • Eastern falcon (*Falco novaeseelandiae novaeseelandiae*)
>
> • Bush falcon (*Falco novaeseelandiae ferox*)
>
> • North Island weka (*Gallirallus australis greyi*).

Regulation 102(2) outlines the procedures that must be in place and followed when *plantation forestry activities* occur in areas where the above bird species are nesting as follows:

> *(a) Confirm and recognise the presence of the indigenous bird species identified in subclause (1); and*
>
> *(b) On confirmation of presence, identify affected nest sites; and*
>
> *(c) Provide staff with training on recognising the presence of individual bird species if encountered during the plantation forestry activity; and*
>
> *(d) Avoid or mitigate adverse effects on affected nest sites and indigenous bird species.*

In addition to the indigenous bird nesting regulations in the NES-PF, there are requirements in the Wildlife Act 1953 relating to the protection of wildlife that foresters need to be aware of and comply with.

Compliance with Regulation 102 will require foresters to have procedures in place to identify where bird species listed in Regulation 102(1) are nesting and put the procedures outlined in Regulation 102(2) in place if the presence of nesting sites are confirmed. It is good practice for foresters to document the procedures that they intend to follow to meet the requirements of Regulation 102.

The NES-PF does not prescribe the procedures that must be in place to avoid or mitigate adverse effects on affected nest sites and indigenous bird species listed in Regulation 102(1). This is to allow foresters flexibility to adopt appropriate procedures based on the nature of their operation and the bird species present. It may involve training for staff to recognise the presence of species and procedures to be followed in the event that the species or nest is encountered.

Existing guidance that may be referred to when complying with Regulation 102 includes:

• Forest Owners Association's 'Rare Species' website[76]

• The Kiwis for Kiwi's '*Forestry Management Guidelines, North Island Brown Kiwi in Exotic Plantation Forests'* [77]

APPENDIX 12: SCHEDULE 3 CHECKLIST FOR EARTHWORKS AND HARVESTING MANAGEMENT PLAN

NATIONAL ENVIRONMENTAL STANDARDS – PLANTATION FORESTRY

SCHEDULE 3 – CHECKLIST

FORESTRY EARTHWORKS MANAGEMENT PLAN & HARVEST PLAN

PLANNING CHECKLIST NES-PF	Applicable	Detail / Plan reference (where applicable)
A forestry earthworks **management plan** must include the information set out in clauses 1, 2, 3, 4 & 6.	☐	
A **harvest plan** must include the information set out in clauses 1, 2, 3, 5 & 6.	☐	

A combined forestry earthworks management plan and harvest plan must include all of the information set out below.

1. Person and property details

The person and property details are –

(a)	The plan date	☐
(b)	The name of, and contact details for the landowner or their agent	☐
(c)	The name of, and contact details for the forest owner (if different)	☐
(d)	The name of, and contact details for the harvest and earthworks managers (if different)	☐
(e)	The contact details for service – postal address, email and contact telephone numbers	☐
(f)	The region and district in which the forest is located	☐
(g)	The name of the road used for forest access and rural number of entry point	☐
(h)	The forest name or property location identifier	☐
(i)	The cadastral and map references, or GIS polygon reference.	☐

2. Map

The plan must include a map (or maps) that include and show –

(a)	A scale not less than 1:10,000	☐
(b)	The computer freehold register, the date, and a north arrow	☐
(c)	The harvest area boundary	☐
(d)	The external property boundaries within 200 m of the harvest and earthworks area	☐
(e)	The contour lines at less than, or equal to 20 m intervals	☐
(f)	The erosion susceptibility classification (NES-PF overlay map)	☐
(g)	The proposed harvesting method (hauler or ground-based, or other) and arrows showing extraction directions to the skid or landing	☐
(h)	The proposed forestry road locations, and landing or skid locations	☐
(i)	Any on-site risk areas as identified under clause (3).	☐

PLANNING CHECKLIST NES-PF	Applicable	Detail / Plan reference (where applicable)
3. Water and on-site areas		
Water on site The plan must identify the location of (and mark on a map) –		
(a) Wetlands larger than 0.25 ha and lakes larger than 0.25 ha	☐	
(b) Rivers to their perennial extent	☐	
(c) Rivers where the bank full channel width is 3 m or more	☐	
(d) Any outstanding freshwater body or water body subject to a water conservation order	☐	
(e) The coastal marine area	☐	
(f) Any setbacks.	☐	
Downstream risks The plan must –		
(a) For sites with a perennial river, identify the risks downstream of the operation (should slash or sediment be mobilised) to any:		
(j) public roads and other infrastructure	☐	
(ii) downstream properties (and show the location of dwellings)	☐	
(iii) downstream river, lake, estuary or sea	☐	
(b) Identify any registered drinking water supply, including drinking water sources for more than 25 people, within 1 km downstream of the activity.	☐	
On-site risks The plan must identify the location of (and mark on a map) any features that are to be protected during the operation, including significant natural areas.	☐	
Forestry infrastructure The plan must identify the location of (and mark on a map) any –		
(a) Existing roads, tracks, landings firebreaks and river crossings	☐	
(b) Proposed new roads, tracks, landings, firebreaks, river crossings (permanent and temporary), and fuel storage and refuelling sites	☐	
(c) Proposed end-haul deposit sites	☐	
(d) Slash storage areas.	☐	
4. Forestry earthworks management plan The plan must –		
(a) Identify the area to which the plan applies	☐	
(b) Describe the scope of work covered by the earthworks and whether it is for maintenance, upgrade, road widening, realignment, or new works	☐	
(c) Indicate the anticipated construction time for forestry earthworks and stabilisation	☐	

PLANNING CHECKLIST NES-PF	Applicable	Detail / Plan reference (where applicable)
(d) Describe clearly the management practices that will be used to avoid, remedy, or mitigate risks due to forestry earthworks that have been identified on the map, including the proposed erosion and sediment control measures to be used and the situations in which they will be used, in sufficient detail to enable site audit of the management practices to be carried out.	☐	
(e) Include the following for earthworks management:		
(i) water run-off control measures	☐	
(ii) sediment control measures during construction and during harvest	☐	
(iii) the method used to manage excess fill for large-scale cut and fill operations, and if end haul, the proposed disposal location	☐	
(iv) methods used to stabilise batters, side cast, and cut and fill	☐	
(v) post-harvest remedial work (timing and methods).	☐	
5. Harvest plan The plan must include –		
(a) The harvesting method, whether ground-based or hauler (or any other method), and the hauler system type	☐	
(b) The planned timing, duration, intensity, and any proposed staging of the harvest	☐	
(c) The management practices that will be used to avoid, remedy, or mitigate risks due to forest harvesting on features identified under clause 3(3) and mapped, including the slash management and procedures for –		
(i) avoiding instability of slash at landing sites	☐	
(ii) keeping slash away from high-risk areas (no-slash zones)	☐	
(iii) slash management in the vicinity of waterways, including identifying any areas where it would be unsafe or impractical to retrieve slash from water bodies	☐	
(iv) measures to ensure that slash is not mobilised in heavy rain events (5% AEP or greater) and contingency measures for such movement, including requirements for slash removal from streams and use of slash traps	☐	
(d) Any operational restrictions to –	☐	
(i) minimise damage to indigenous vegetation	☐	
(ii) avoid damage to downstream and adjacent infrastructure and properties.	☐	
6. Management practices for maintenance and monitoring The plan must include –		
(a) The proposed routine maintenance and monitoring processes	☐	
(b) The proposed heavy rainfall contingency and response measures, including		
(i) specific triggers or thresholds for action; and	☐	
(ii) post-event monitoring and remedial works	☐	
(c) The post-harvest monitoring of residual risks, and the corrective action processes.	☐	

Figure 9: NES - PF schedule 3 checklist

APPENDIX 13: EXAMPLE OF A HARVEST PLAN MAP

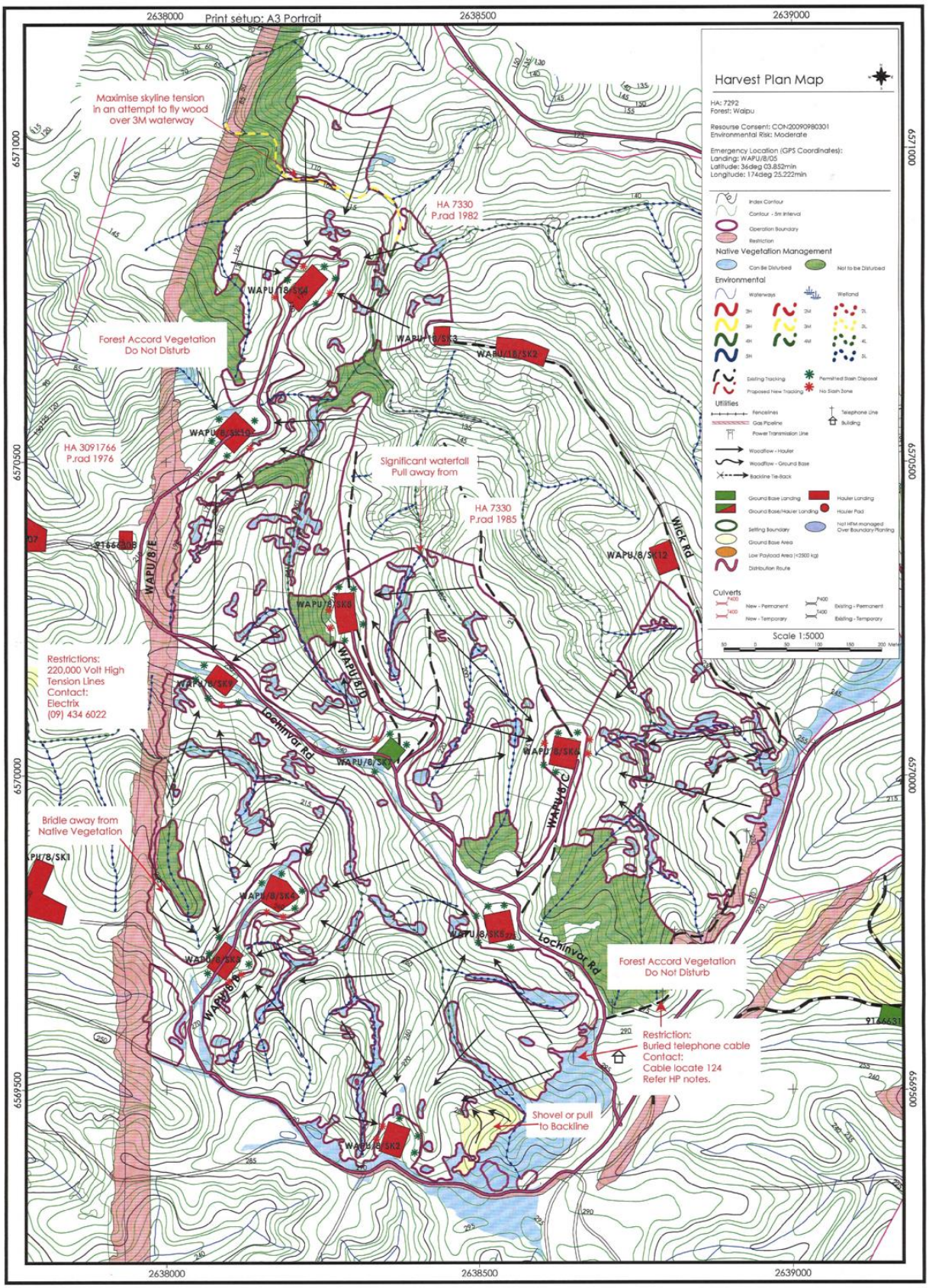


Figure 10: Example of a harvest map

APPENDIX 14: EXAMPLE OF A SLASH MANAGEMENT PLAN / CHECKLIST

SLASH MANAGEMENT PLAN / CHECKLIST

Forest ..... **Harvest Area** .....

Contractor ..... **Crew** .....

Audit By ..... **Audit Date** .....

Environmental Requirements – Waterbodies	Complies?		
	Yes	No	NA
Does extraction across the water body require resource consent?			
Have the waterways within the harvest area been assessed / classified? (refer Appendix 9)			
Has all slash been removed from significant waterbodies marked on the harvest plan?			
Does extraction across the water body result in the least environmental impact? (Consider cost / land tenure or ownership / LUC (erosion) risk)			

Options to minimise effects extracting across waterbodies

Skyline extraction system: • Butt pull with butts elevated / raised
North bend and extract via corridors: • Recognise inflated volume travelling each skyline set – Manage / mitigate gouge / trench lines leading to water body • Extract / remove slash from water body

Environmental Requirements – Landings	Complies?		
	Yes	No	NA
Volume of slash has been assessed			
What is the harvest area / catchment Land Use Classification (LUC)? (refer Appendix 1)			
Has slash been used on tracks to trap sediment and reduce runoff and compaction?			
Are there any slash / waste wood issues that need urgent attention (stabilising/recovery)?			
Is spilled slash / waste wood sitting on a visible bench?			
Is there a large volume of slash / waste wood sitting on landings?			
Will mobilisation of accumulated slash / waste wood on landings pose any post harvest risk?			
Is remedial burning or pull back required?			

Other Considerations	Complies?		
	Yes	No	NA
Has logging slash been managed as per the harvest plan?			
Catchment size			
Geology			
Have the ecological values within the catchment been determined? (refer Appendix 10)			
Are there any domestic water takes within 500m downstream of the harvest boundary?			
Amount of material, e.g. short mush, likely to be channelled off each landing			

The following outlines considerations for slash management and any associated corrective actions required to stabilise the landing and surrounding area:

Description	Action
Slash is stable	• Slash has been pulled back onto landing. • Water management on landings and roads in good condition. • Sediment controls in good condition. • Slash within waterbodies managed as per stream classification requirements.
Slash is slightly unstable	• Slash has been pulled back onto landing. • Water management on landings and roads needs maintenance. • Sediment controls require maintenance. • Slash within waterbodies managed as per stream classification requirements.
Slash is moderately unstable	• Slash has been pulled back onto landing but large volume is weighing the landing down. • Water management on landings and roads leading to landing inadequate. • Sediment controls require maintenance or are inadequate. • Slash in waterbodies not managed as per stream classification requirements.
Slash is unstable	• Slash appears to be hanging on the edge and/or slash is weighing the landing down. • Water management on landings and roads leading to landing is inadequate or non-existent. • Sediment controls require maintenance, or are inadequate or non-existent. • Slash in waterbodies is not managed as per stream classification requirements. • Within a sensitive catchment area.
Slash is very unstable	• Cracks on the landing. • Slash appears to be hanging on the edge and/or slash is weighing the landing down. • Water controls on landings and roads leading to landing are inadequate or non-existent. • Sediment controls require maintenance, or are inadequate or non-existent. • Slash in waterbodies is not managed as per stream classification requirements. • Within a sensitive catchment area.

Signed:

Contractor	**Supervisor**	**Date**

Figure 11: Example of a slash management plan

APPENDIX 15: WETLANDS IN FORESTRY BLOCKS – A SUMMARY

The main wetland types found in forestry blocks are:

- Swamps
- Marshes
- Fens
- Bogs
- Gumlands
- Dune lakes and associated wetlands.

More fertile wetland types such as **swamps** and **marshes** are generally found on valley floors and are the most common wetlands in hilly forestry blocks. These wetlands are fed by run-off from surrounding country with some groundwater inputs. They are characterised by a range of fertility loving species – raupo, flax, cabbage trees, rushes, carex sedges and occasionally tree species such as kahikatea, manuka, pate and mamaku (black tree fern). Fertile wetlands, especially swamps, are fairly resilient because, provided they aren't drained or disturbed with heavy machinery, they adjust to or recover from some degree of water level fluctuation or disturbance.

Less fertile wetland types such as **fens** and **bogs** are generally rarer and do not recover well from disturbance. Nutrient inputs from surrounding land use and disturbance during felling operations are a particular issue for these wetlands. Fortunately being on gentler to flat country, often in areas of old fixed sand dunes, they are easier to log around. Less fertile, acidic wetlands are characterised by rush-like sedges, wire rushes, sun dews, native orchids and manuka.

Gumlands are an ultra-infertile shrub land on old kauri country usually on gently sloping ridge crests. Because they are dry most of the year, gumlands are overlooked as wetlands but their hard pan, which impedes drainage, means they are usually wet in winter and therefore share some of the same plants as bogs. Providing this pan is not broken by heavy machinery, gumlands persist, though nitrogen fixing weeds such as gorse and wattle which increase fertility are an issue. Fire also opens them up to weeds such as hakea. Gumlands are not common in forestry blocks, as most have now been developed, but there are patches left in many of our forests and these should be retained as significant wetlands.

Dune lakes and their associated wetlands are found in many of the sand forests at Poutō, North Dargaville, Aupōuri and in the Far North. The water quality in these lakes is naturally good, because they have a low nutrient status though peat staining is common. Dune lakes are an asset to any forestry block as water storage. To keep them in good condition care should be taken to avoid nutrient inputs from run-off, to keep stock out of them and to avoid felling trees into their margins. In addition, during roading care should be taken to channel run-off into sediment ponds or away from the lakes. Dune lakes are also vulnerable to aquatic weeds brought in inadvertently on machinery or by people, most commonly by eel fishers.

APPENDIX 16: SWAMPS

NORTHLAND WETLAND TYPES

Swamps

What is a swamp? | Why are swamps so important? | Vegetation | Animals | Looking after your swamp

WHAT IS A SWAMP?

Swamps, the most fertile type of wetland, are found on valley floors and in basins. They receive much of their water as runoff from surrounding land which supplies a rich source of nutrients. In their base, swamps have a mixture of decomposing plant matter (peat) and soil. They are very wet so there are often areas of shallow water (see Lakes and shallow water fact sheet). Swamps may be the most common wetland left but more have been drained and cleared than any other type of wetland so those that are left are precious.

WHY ARE SWAMPS SO IMPORTANT?

Swamps are home to a diverse range of animals and plants that can not live and grow anywhere else. Swamps can be a real asset on any farm, horticultural or forestry block and are worth looking after, restoring or even creating. They act as filters and purifying agents for rivers and streams, improving water quality by filtering out nutrients and sediments from runoff. They act as giant sponges by absorbing water and releasing it slowly to keep streams flowing during dry periods. A good swamp can store up to 10 million litres of water per hectare! Studies in America have also shown that catchments with one third of their area as wetlands or lakes, reduce storm flood peaks by 60-80 percent.

VEGETATION

Raupō swamp, Parua Bay.

Because swamps are so fertile they support a diversity of plant life and vary in their appearance. The most common swamps in Northland are raupō and flax swamps. Other plants such as cabbage tree (ti kouka), reeds, rushes, tussock sedges (*Carex* and *Cyperus*), swamp millet, and pink bindweed also make a home here. Forests with tall trees are uncommon and have species which tolerate wet feet - kahikatea, pukatea and swamp maire.

Rotu Bottleneck swamp forest, Dargaville.

Kahikatea swamp, Dargaville.

ANIMALS

Common birds which are seen in swamps are pukeko, and harrier hawk. Three rare wetland birds are Australasian bittern, spotless crake and fernbird. If your swamp has open water then there will be other bird species especially if you are doing predator control. Open water invites white-faced herons, paradise shell ducks, mallards and possibly even grebes or teal. The golden bell frog is also found in many swamps and their croaking can be heard from a distance. Fish species such as eels and banded kokopu are also found in swamps especially if they are accessible from the sea.

Pukeko.

Australasian bittern.

LOOKING AFTER YOUR SWAMP

You may be eligible for a Northland Regional Council Environment Fund grant for up to 50 percent of the costs of wetland fencing, pest control and planting.

Hydrology (water levels)

The water in your swamp will fluctuate naturally over the year. However, the way the surrounding land is being managed may be degrading your wetland by influencing water levels. Generally if a wetland looks healthy it means the water levels are stable, even if changes have occurred in the past. Vegetation dieback, weed invasion or a change in the plant community usually indicates that water levels have altered probably because of works nearby. Often this is simple to rectify without lowering the productivity of the surrounding land. It may mean putting in a weir to retain summer water levels, filling in a drain or simply not maintaining a drain.

Remember that before you make any changes to the water levels in a wetland you need to contact the Northland Regional Council as you may need a resource consent.

Plant pests

Maintaining water levels and avoiding drainage and earthworks will help stop invaders such as pampas, gorse and Mexican devil. There are other plants which can establish if your swamp is downstream of a weed source including reed sweet grass (*Glyceria*), willows, alligator weed, wandering jew and hornwort. Japanese honeysuckle, which is spread by birds, can be difficult to control in flax swamps.

Some herbicides are not allowed to be used over water or in wetlands so please contact a Northland Regional Council Biosecurity Officer for advice before you start.

Here are some things you can do to keep the weeds out:

- Avoid drainage or disturbance that will favour weeds;
- Fence stock out to reduce disturbance and prevent weed spread;
- Wash and dry spades and machinery after working in weedy areas or off farm; and
- Eradicate weeds upstream before they spread.

Animal pests

When it comes to animal pests, there are some basic rules of thumb:

- Wetland birds respond well to basic pest control while others such as brown teal (pateke) and bittern may need a little more help.
- Pest animals in wetlands include possums, stoats, weasels, ferrets, hedgehogs, rats and cats.
- Wandering dogs harass or kill native birds.
- Rabbits, hares, goats and possums browse native plants.

Fencing your wetland is great but it may favour predators so follow fencing with pest control. Fortunately basic predator control is as easy as a line of traps or bait stations around the edge of the wetland.

Contact a Northland Regional Council Biosecurity Officer for advice on the best pest control for your situation and to apply for funding.

Nutrients

Swamps, being fertile systems, are resilient and seem to cope with small amounts of added nutrients. Swamps are well known for the work they do to filter nutrients and sediments however, it is still important that inputs of these things are kept as close to natural levels as possible. Avoid pasture runoff and fertiliser drift and do not allow stock to access wetlands or their margins. When you fence, allow a sufficient margin as a buffer and to capture runoff.

Stock

Stock, especially heavier animals, do a huge amount of damage to swamps so it's not a good idea to use them as a source of summer feed or as a runoff. Pugging breaks through peat damaging the crowns of raupō and other reeds causing these plants to die. Animals browse plants such as flax, cabbage tree, sedges and pukatea. Large swamps or those with deep, wet, peat bases are less vulnerable because stock are unable to push far into them but smaller shallower swamps and swamp forests should be fenced.

Contact the Northland Regional Council for advice on how to apply for funding.

Ponds or dams

Digging a pond in your existing swamp or damming outlets to create open water is not necessarily beneficial for your wetland.

Please contact the Northland Regional Council for advice and before considering creating a dam or pond as you may need a resource consent.

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APPENDIX 17: BOGS

NORTHLAND WETLAND TYPES

Bogs

What is a bog? | Why are bogs so important? | Vegetation | Animals | Looking after your bog

WHAT IS A BOG?

Striped sun orchid, *Theymitra pulchella* is found in bogs.

Bogs are very infertile wetlands found on flat land or shallow basins. They have acid soils and their main source of water is from rain so they do not receive nutrients from run off. The water table is close to the ground surface. In bogs the wet, oxygen-starved conditions make dead plant matter–from sphagnum moss and wire rush–decompose slowly, forming deep layers of black peat. Many bogs, especially in the Far North, are on top of ancient kauri forests so are full of old logs and sometimes gumholes from the gumdigging era. Bogs are often associated with gumlands on the ridges (see Gumland fact sheet).

Tussock sedge and wire rush bog, Kaitāia.

WHY ARE BOGS SO IMPORTANT?

Bogs are rare wetlands and in Northland are now found mostly in the Far North. They contain unusual communities of plants and animals adapted to live in low fertility, acid conditions. Black mudfish are very rare and bogs are one of a few homes for them. Other animals such as fernbirds, bitterns and green gecko are also found in bogs.

VEGETATION

Flowering forked sundew.

Bogs contain unique plant communities adapted to the acid, infertile conditions. Stunted vegetation often has short sedges, wire rushes, sphagnum moss and tangle fern. Manuka, a shrub which can tolerate wet feet and infertile conditions, is also common in bogs. Bogs are home to many rare plants including sundews, tiny ferns, mosses and liverworts and beautiful species of native sun orchid.

ANIMALS

Black mudfish and Northland mudfish are now very rare and live in bogs. During summer these fish are able to survive up to two months in damp peat, only needing shelter from vegetation to keep them moist. Fernbirds are also found in many bogs. Other birds that might be visiting bogs are bitterns and spotless crakes. Green geckos can sometimes be seen sunning themselves on the stems of plants on warm days.

Black mudfish. © *Copyright: Rod Morris.*

Fernbird.

LOOKING AFTER YOUR BOG

You may be eligible for a Northland Regional Council Environment Fund grant for up to 50 percent of the costs of wetland fencing, pest control and planting.

Nutrients

Because bogs are low fertility, acidic wetlands they are extremely vulnerable to increases in fertility and acidity (pH).

Increases in fertility will cause vegetation to change allowing pest plants to grow more easily, e.g. gorse, hakea, broom, bottlebrush, woolly nightshade and acacia. Some weeds – such as gorse – fix nitrogen and increase soil fertility which causes even more damage.

Prevent increases in soil fertility in bogs by:

- Managing the basin or any catchment area that feeds the bog;
- Preventing fertiliser drift and runoff especially lime fertiliser as this will increase the pH;
- Controlling weeds which fix nitrogen – gorse, acacia (wattle), oxylobium and dally pine (*Psoralea*); and
- Preventing nutrients from septic tanks and effluent from entering the water table/aquifer.

Hydrology (water levels)

Peat forms in bogs because low oxygen levels in the saturated soil makes dead plant material decompose slowly. When bogs are drained oxygen penetrates the peat (oxidises) causing it to shrink and the land surface to lower. Unfortunately once this happens it is extremely difficult to restore the peat as it can take thousands of years to rebuild.

Bogs often have a hard layer of material (a pan) beneath them which helps to hold the water so digging drains or doing earthworks, even nearby, can break the pan and cause water levels to drop. The way to look after peat soils, both on farms and in bogs is to make sure the water levels are maintained so the peat stays damp, though some drying over summer is natural. It may mean putting in a low weir to retain water, filling in a drain or not maintaining a drain.

Remember that before you make any changes to the water levels in a wetland you need to contact the Northland Regional Council, as you may need a resource consent.

Plant pests

Maintaining water levels and avoiding fires, drainage, earthworks and damage by vehicles or stock trampling will help prevent weed invasion. Weeds in the legume (pea) family – gorse, acacia, broom and oxylobium – fix nitrogen and increase soil fertility, doing even more damage. Fires help spread many weeds enabling them to take over the native plants. The peat means fires can be very difficult to put out in bogs.

Some herbicides are not allowed to be used over water or in wetlands so please contact a Northland Regional Council Biosecurity Officer for advice before you start weed control.

You can keep the weeds out by:

- Avoiding fires, drainage or disturbance that will favour weed invasion;
- Fencing stock out to reduce disturbance and prevent weed spread;
- Washing and drying equipment and farm machinery after working in weedy areas or off your land.

Animal pests

When it comes to animal pests, there are some basic rules of thumb:

- Black mudfish and frogs can't cope with gambusia (mosquito fish) so make sure you don't introduce them.
- Wetland birds, lizards and invertebrates respond well to basic pest control.
- Pest mammals include rabbits, possums, stoats, weasels, ferrets, hedgehogs, rats and cats.
- Wandering dogs harass or kill native birds.
- Hares and rabbits in particular, browse the young stems of native orchids and other bog plants along tracks or in open areas.

Basic predator control is as easy as a line of traps or bait stations along tracks or around the edge of the bog.

Contact a Northland Regional Council Biosecurity Officer for advice on the best pest control methods for your situation and to apply for funding.

Stock

Bogs are not a valuable source of feed for stock. Heavier animals especially do a lot of damage so it's never a good idea to allow them access. Pugging breaks through peat and stock browse softer plants. Farm animals can spread weeds or open up areas for weeds to move into.

Contact the Northland Regional Council for advice on fencing and how to apply for funding.

Ponds or dams

Digging ponds or damming outlets to create open water is not beneficial for bog wetlands.

Please contact the Northland Regional Council for advice and before considering creating a dam or pond as you may need a resource consent.

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APPENDIX 18: FENS

NORTHLAND WETLAND TYPES

Fens

What is a fen? | Why are fens so important? | Vegetation | Animals | Looking after your fen

WHAT IS A FEN?

Fens are low to moderate fertility wetlands that are fed by both groundwater and surface runoff. They usually occupy gently sloping ground such as the toes of hillsides. The main feature is that the water table is close to the surface so they are very wet with slow to moderate water movement. The water table does not fluctuate much throughout the year. Being on slightly sloping ground, fens are more fertile than bogs though they can share some of the same features. They often grade into more fertile swamps. Generally there is a build-up of peat from the breakdown of dead plant matter. Fens are rare in Northland and are sometimes confused with swamps.

Aurere Stream wetland, Karikari.

Maitahi Scientific Reserve, north of Dargaville.

WHY ARE FENS SO IMPORTANT?

Fens are one of the rarest wetland classes in Northland and contain a very high diversity of plant and animal life because they share some of the features of low fertility bogs as well as higher fertility swamps. Black mudfish are rare and fens are one of a few homes for them. Other animals such as fernbirds, bitterns and green gecko are also found in these areas. Fens are wet all year round storing water and releasing it slowly during dry periods. They also act as filters for streams and rivers lower down, improving water quality by capturing runoff and scrubbing out nutrients and sediments.

VEGETATION

Spiranthes orchid.

Fen vegetation in Northland is often made up of sedges including *Baumea* and *Schoenus*, ferns, flax and also manuka. In less fertile areas there may be bog vegetation (see Bogs fact sheet) and further down or around areas of flowing water there may be vegetation such as cabbage trees (ti kouka) and raupō which characterise fertile swamps (see Swamps fact sheet). This can lead to a very high plant diversity especially around the zones where there is a boundary between habitats (ecotones).

ANIMALS

Some of Northland's fens have high populations of rare black mudfish. During summer these fish are able to survive for up to two months in damp peat only needing shelter from vegetation to keep them moist. Fernbirds are also found in fens. Other birds that might be visiting fens are bitterns and spotless crakes. Green geckos can sometimes be seen sunning themselves on the stems of plants on warm days.

Fernbird.

Black mudfish.

LOOKING AFTER YOUR FEN

You may be eligible for a Northland Regional Council Environment Fund grant for up to 50 percent of the costs of wetland fencing, pest control and planting.

Hydrology (water levels)

Fens have flowing water all year round and the water table, which is close to the surface, does not fluctuate greatly. It is important that water levels in fens are kept stable and retained. Drainage of surrounding land may be degrading your fen by lowering the water levels causing areas to dry out and become weedy. Peat forms in fens because low oxygen levels in the saturated soil causes dead plant material to decompose slowly. When fens are drained, oxygen penetrates the peat (oxidises) causing it to shrink and the land surface to lower. Unfortunately once this happens it is extremely difficult to restore the peat as it can take thousands of years to rebuild. The way to look after peat soils, both on farms and in wetlands is to make sure the water levels are maintained so the peat stays damp. It may mean putting in a weir downstream to retain water levels, filling in a drain or not maintaining a drain.

Remember that before you make any changes to the water levels in a wetland you need to contact the Northland Regional Council, as you may need a resource consent.

Nutrients

Because fens are low to moderate (intermediate) fertility they are vulnerable to nutrient inputs. Increases in fertility will cause vegetation changes. Fertility loving native plants - such as raupō and cabbage trees - generally favour fens because they are so wet. However, to retain the intermediate fertility characteristics of these rare ecosystems, it is important to keep inputs of nutrients as close to natural levels as possible.

Prevent increases in fertility in fens by:-

- Managing the basin or any catchment area that feeds the fen;
- Preventing fertiliser drift and runoff;
- Fence out stock with a marginal buffer to prevent effluent and pasture runoff reaching the fen.

Stock

Stock, especially heavy animals, do a great deal of damage to wet fens and they are not a good source of feed. Pugging breaks through peat, damages raupō crowns and stock browse softer plants. Animal effluent can also lead to increases in fertility on the margins. Stock also spread weeds or open up areas for weeds to move into. Stock don't generally push far into larger fens but smaller ones should be fenced.

Contact the Northland Regional Council for advice on fencing and how to apply for funding.

Plant pests

Maintaining water levels and avoiding drainage especially downstream will help stop invaders like gorse, pampas and Mexican devil. Some herbicides are not allowed to be used over water or in wetlands so please contact the Northland Regional Council for advice before you start weed control.

You can keep the weeds out by:

- Avoiding drainage or disturbance that will favour weed invasion;
- Fencing stock out to reduce disturbance and prevent weed spread;
- Washing and drying equipment and farm machinery after working in weedy areas or off your land;
- Eradicating weeds, especially any that can spread from higher up the catchment.

Animal pests

When it comes to animal pests, there are some basic rules of thumb:

- Black mudfish and frogs can't cope with gambusia (mosquito fish) so make sure you don't introduce them.
- Wetland birds, lizards and invertebrates respond well to basic pest control.
- Pest mammals include rabbits, possums, stoats, weasels, ferrets, hedgehogs, rats and cats.
- Wandering dogs harass or kill native birds.

Basic predator control is as easy as a line of traps or bait stations along tracks or around the edge of the wetland.

Contact a Northland Regional Council Pest Officer for advice on the best pest control methods for your situation and to apply for funding.

Ponds or dams

Digging ponds or damming outlets to create open water is usually not beneficial for fen wetlands.

Please contact the Northland Regional Council for advice and before considering creating a dam or pond as you may need a resource consent.

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APPENDIX 19: GUMLANDS

NORTHLAND WETLAND TYPES

Gumlands

What is a gumland? | Why are gumlands so important? | Vegetation | Animals | Looking after your gumland

WHAT IS A GUMLAND?

Epakauri Gumland south of Ahipara.

Gumlands are similar to the pakihi wetlands found further south. They are the least fertile and most acidic of the wetlands and are normally found on gently sloping ridges where ancient kauri forests once grew. Over thousands of years the kauri dropped acid litter causing nutrients and organic material to leach out of the soil. This left behind a hard silica pan (base) which is a barrier to water draining away. Fires are a feature of gumlands causing further loss of nutrients. Gumlands are often not recognised as wetlands because they are on hilltops. In summer they can dry completely and in winter they may be water logged. They receive all of their water from rain. In hollows, wet peat bogs can form (see Bogs fact sheet).

WHY ARE GUMLANDS SO IMPORTANT?

Gumlands are uniquely associated with ancient kauri forests and help define the natural character of the Northland Region. They played a part in Northland's early European history drawing thousands of settlers to seek their fortune digging kauri gum from the gumfields. Gumlands are home to an unusual community of plants and animals that have adapted to survive in harsh, infertile environments, many of which are now rare. Once very common in Northland, most gumlands have been cleared and developed.

VEGETATION

Native striped sun orchid, *Thelymitra pulchella*.

Gumland is often confused with scrub but a closer look will reveal a unique community of plants many of which are shared with the acid, infertile bogs. Stunted, short manuka may be dominant. *Schoenus brevifolius* and *Baumea* sedges (wiwi), tangle fern (*Gleichenia dicarpa*) and *Dracophyllum lessonianum* can be abundant. A search on the ground and along track edges will reveal a treasure trove of native orchids, tiny ferns and sundews, some of which are very rare.

ANIMALS

Although the wetland birds that use open water may not be present in this wetland type it does provide habitat for many forest bird species such as fantails and tuis. Gumlands are also prime habitat for the Northland green gecko, North Island brown kiwi and North Island fernbird. Black mudfish and endemic Northland mud fish sometimes live in wet hollows and gumholes.

Fernbird.

Northland green gecko. © Copyright DOC.

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LOOKING AFTER YOUR GUMLANDS

You may be eligible for a Northland Regional Council Environment Fund grant for up to 50 percent of the costs of wetland fencing, pest control and planting.

Nutrients

Gumlands are low fertility, acidic wetlands and are extremely vulnerable to increases in fertility and acidity (pH).

Changes in fertility will cause vegetation to change and pest plants to grow more easily, e.g. gorse, hakea, broom, woolly nightshade and acacia. Some weeds – such as gorse – fix nitrogen and increase soil fertility further, doing even more damage.

Prevent increases in fertility in gumlands by:

- Avoiding fertiliser drift;
- Avoiding lime fertiliser as this will increase the pH; and
- Controlling weeds which fix nitrogen – gorse, acacia (wattle), oxylobium and dally pine *(Psoralea)*.

Plant pests

Gumlands, being a drier type of wetland, are very vulnerable to woody weeds, many of which are spread by fire. Avoiding fires, earthworks, drainage, and damage by vehicles or stock trampling will help prevent weed invasion. Weeds in the legume (pea) family such as gorse, acacia, broom and oxylobium fix nitrogen and increase soil fertility doing even more damage. Fires can help spread many of these weeds so they take over the native plants.

Please contact a Northland Regional Council Biosecurity Officer for advice and to apply for funding before you start weed control.

You can keep the weeds out by:

- Avoiding fires, earthworks or disturbance that will favour weed invasion;
- Fencing stock out to reduce disturbance and prevent weed spread;
- Washing equipment and farm machinery after working in weedy areas or off your land.

Hydrology (water levels)

Gumlands form on gently sloping ridges where ancient kauri forests once grew. Over thousands of years the kauri dropped acid litter causing nutrients and organic material to leach (wash) out of the soil leaving behind a hard, white silica pan (base). This pan set like concrete acting as a barrier to water draining away so a wetland formed on top. Because gumlands are on ridges and rely totally on rainfall they are usually parched dry in summer and saturated in winter. A layer of peat will usually form and permanently wet hollows may be peat bogs (see Bogs fact sheet). Destroying or ripping the clay pan that underlies the gumland with machinery will mean that the pan leaks water downwards causing the gumland to become drier in winter. The vegetation may then become weedy or change to shrubland.

Remember that before you do any works in a gumland you need to contact the Northland Regional Council, as you may need a resource consent.

Animal pests

When it comes to animal pests, there are some basic rules of thumb:

- Black mudfish and frogs can't cope with gambusia (mosquito fish) so make sure you don't introduce them.
- Wetland birds, lizards and invertebrates respond well to basic pest control.
- Pest mammals include rabbits, possums, stoats, weasels, ferrets, hedgehogs, rats and cats.
- Wandering dogs harass or kill native birds.
- Rabbits, in particular, browse the young stems of native orchids along tracks or open areas.

Basic predator control is as easy as a line of traps or bait stations along tracks or edges.

Contact a Northland Regional Council Biosecurity Officer for advice on the best pest control methods for your situation and whether you are eligible for funding.

Stock

Gumlands are a poor source of feed and stock do a lot of damage so its not a good idea to allow them access or use gumlands as runoffs. Pugging breaks through peat in wetter hollows and stock browse softer plants. Farm animals can spread weeds or open up areas for weeds to move into.

Contact the Northland Regional Council for advice on fencing and how to apply for funding.

Ponds or dams

Earthworks are not recommended in gumlands as this will seriously damage their clay pan.

Please contact the Northland Regional Council for advice and before considering creating a dam or pond as you may need a resource consent.

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APPENDIX 20: SHALLOW LAKES AND OPEN WATER

NORTHLAND WETLAND TYPES

Lakes and shallow water

What is a lake or shallow open water wetland? | Why are lakes and wetlands with open water so important? | Vegetation | Animals | Looking after your lake or shallow water

WHAT IS A LAKE OR SHALLOW OPEN WATER WETLAND?

Lake Ngakeketa, a dune lake in the Far North.

True lakes are greater than two metres deep. Some of our larger wetlands include shallow lakes and open water areas less than two metres deep, often with marsh wetlands around the edges. Northland has more than 600 lakes including some of the best and biggest dune lakes in the country.

Dune lakes can be found in only five places in the world and are globally endangered. Lakes get their water from many sources including rain, runoff, ground water and geothermal activity. Volcanic lakes are a feature of central Northland. Water clarity and quality depends on the type of lake and its condition. Good dune lakes have clear, low nutrient water while others have nutrient rich water as a result of grazing or runoff from surrounding land.

WHY ARE LAKES AND WETLANDS WITH OPEN WATER IMPORTANT?

Lakes are home to a unique range of native algae and aquatic plants. Because there are few lakes left with good water quality many of these plants are now threatened. There are many fish and water birds that use open water, some of which like scaup, and brown teal are rare.

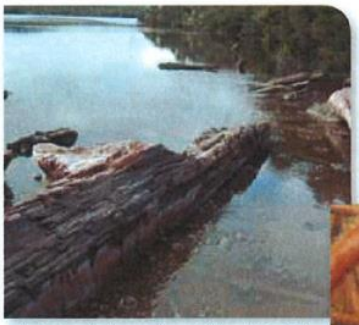
Native *macrophyte* beds in Te Paki Dune Lake.

Lakes are important for storing clean water and can be a real asset on farms or in pine forests.

They can also help reduce peak flood levels during storms. Many of the best Northland lakes are popular for recreational swimming and boating. Duck shooting is a widespread sport in areas of shallow open water while eels are harvested for food.

VEGETATION

Vegetation of open water varies depending on the type of bottom sediment and the water quality. Clear lakes usually have a dense bottom cover of native *macrophyte* plants including freshwater *charophytes* (algae), pond weeds and milfoils.



Lake Waiparaheka geothermal lake, Ngāwhā is unusual because aquatic plants can't grow in the geothermal water.

Inganga in Lake Morehurehu.

In Lake Taharoa at Kai Iwi plants grow down to around 27 metres, the deepest growing vegetation of any lake in the North Island. On lake margins there may be reed beds of raupō, kuta, or lake clubrush. Rare plants of shallow water include the tiny endangered water lily relative *Trithuria inconspicua*, native milfoil *Myriophyllum robustum* and the native bladderwort *Utricularia australis* which catches insects in its tiny bladders. Lake margins can be dry over summer leading to low growing plant communities called turfs. A number of tiny rare native annual plants grow in these turfs. Sadly many lakes have been infested by introduced water weeds such as oxygen weeds and hornwort.

ANIMALS

Open water and lagoons are breeding grounds for many birds and native fish such as common bullies. Kokopu, inanga (*Galaxias spp.*) and eels may be present. Shallow water provides habitat for water fowl such as scaup, teal, grebes, dabchicks and wading birds like white faced herons.

LOOKING AFTER YOUR LAKE OR SHALLOW WATER

You may be eligible for a Northland Regional Council Environment Fund grant for up to 50 percent of the costs of wetland fencing, pest control and planting.

Nutrients

The biggest issue for Northland's lakes is decreasing water quality caused by increased nutrients from fertilisers, land runoff, septic tanks, tracks and roads and stock access. Smaller or shallower water bodies and those with big catchments are most affected. Added nutrients – especially phosphates and nitrates – cause the water to increase in fertility (eutrophication) and can lead to toxic algal blooms. Where weeds such as oxygen weed are present, eutrophication can cause lakes to clog with rotting weed. The water clarity may become so bad that all vegetation growing on the bottom dies and the water is no longer useable or safe to swim in. Unfortunately once nutrients are in a lake they are virtually impossible to remove.

What you can do to prevent nutrients entering lakes and shallow water:

- Manage the catchment area that feeds the lake – avoid pugging and over-grazing;
- Prevent fertiliser drift and runoff;
- Don't spread farm effluent near lakes especially on free-draining soils;
- Avoid building septic tanks, offal pits etc near lakes;
- Fence stock away from lake margins leaving an adequate buffer to filter runoff; and
- Stop runoff entering lakes from farm tracks, forestry operations and earthworks.

Contact the Northland Regional Council as you may require sediment ponds and need a resource consent.

Stock

Effluent, especially urine from farm animals grazing on a lake margin increases nutrients in the water. Pugging also causes problems with water quality. Cows browse softer marginal reed beds and break raupō crowns causing dieback.

Contact the Northland Regional Council for advice on fencing and how to apply for funding.

Plant pests

Oxygen weeds (*Egeria, Elodea* and *Lagarosiphon*) and hornwort cause major problems in water bodies. Weeds are commonly moved around on boats, machinery and eel nets. These weeds can grow out of control displacing all native plants especially in lakes affected by nutrient increases. Dense weed beds may start to rot causing algal blooms and making the water toxic to stock and unsafe for swimming. There are other weeds we don't want in Northland which are a problem further south, e.g. yellow flag iris, *Hydrilla*.

Water weeds left to right - hornwort, *Egeria, Elodea,* and *Lagarosiphon*.

Contact a Northland Regional Council Biosecurity Officer for advice.

You can keep weeds out of water bodies by:

- Checking, cleaning and drying all equipment, boats, trailers, nets etc;
- Making sure visitors get the check, clean, dry message;
- Fencing stock out to reduce disturbance and prevent weed spread; and
- Washing and drying equipment and machinery after working in weedy areas or off your land.

Pest fish

Fish such as koi carp, catfish, feral goldfish, tench, perch and rudd do a great deal of damage in water bodies. They stir up the bottom, increase nutrient levels and algal concentrations, eat aquatic plants, compete with native species, and prey on native fish and invertebrates. Black mudfish, native fish and frogs can't cope with introduced gambusia (mosquito fish). It is illegal to introduce pest fish to Northland. Remember that you can bring them in unintentionally as eggs or juveniles on boats and fishing gear so make sure you and visitors to your lake always follow the check, clean, dry message.

Animal pests

When it comes to animal pests, there are some basic rules of thumb:

- Wetland birds respond well to basic pest control.
- Pest animals around water bodies include possums, stoats, weasels, ferrets, hedgehogs, rats and cats.
- Wandering dogs harass or kill native birds.
- Fencing your lake is great but may favour pest predators.

Fortunately basic predator control is as easy as a line of traps or bait stations around the edge .

Contact a Northland Regional Council Biosecurity Officer for advice on the best pest control methods for your situation and to apply for funding.

Contact us:

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Website: www.nrc.govt.nz | **Email:** mailroom@nrc.govt.nz

Facebook: www.facebook.com/NorthlandRegionalCouncil | **Twitter:** www.twitter.com/NRCExpress

NORTHLAND REGIONAL COUNCIL

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