

Fertilization Implementation Plan for Tree Farm License 49

Prepared for:

Tolko Industries Ltd
4280 Highway 6
Lumby, BC V0E 2G7

Prepared by:

Terrafor Resources Ltd.
9304 Aberdeen Road
Coldstream, BC V1B 2K5
Phone (250) 542 2042
Email glen.dick@terrafor.ca



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The following people are acknowledged for their contribution in the preparation of the Okanagan Fertilization implementation strategy:

Keith Boyes, Kathi Bridge, Rob Brockley, Al Hicks, Al Hunter, Bob Johnson, Colleen Marchand, David Myers, Steve Quinn, Tanya Seebacher, Kelly Sherman, John Stace-Smith, Rod Watt.

Executive Summary

The impact of Mountain Pine Beetle (MPB) throughout the interior of BC is projected to impact mid term harvest supply 10 – 50 years from now during 2017-2057. The impact of MPB will reach its maximum in 2015 affecting 41% of harvestable timber in Tree Farm License 49 (TFL 49).

A Vegetation Resource Inventory (VRI) Phase 2 analysis was recently completed on Tree Farm License 49 to determine an accurate estimate of volume existing on the area based tenure of 145,000 hectares. The Silviculture Type 2 Strategy identified that late rotation fertilization is the primary mitigation strategy to grow additional fiber to meet mid-term harvest supply.

The objectives of fertilization in TFL 49 are:

- To mitigate short- and mid-term timber supply impacts through strategically focused fertilization activities,
- To add merchantable volume to existing 25-85 year old stands to ensure earlier operability or contain higher volume when harvested. These treatments will mitigate mid-term timber supply impacts,
- To carry out viable investments in crown land to support both short- and mid-term employment.

Pre-planning is necessary to direct investments to stands which will benefit most from fertilization treatments and maximize financial returns to the Crown.

In 2008, Terrafor Resources Ltd. completed a GIS review of fertilization opportunities on TFL 49. As a result, several stands were identified as potential candidates for late rotation fertilization in TFL 49 and scheduled for fertilization planning and application between 2008 to 2011. The targeted areas are located in the Shorts Creek drainage, Whiteman Creek drainage, and the Salmon River Drainage. The plan has identified 7000 hectares of Douglas Fir and Englemann Spruce for potential fertilization prescriptions. As a direct result of these planning projects, **3272** hectares of candidate Fir or Spruce leading stands are proposed for fertilization between 2008 and 2011.

The project involved reviewing the areas recommended for treatment with respect to:

- areas recently logged or planned for logging,
- updated information on non-timber resource values and,
- First Nation's values and interests

This project resulted in approximately 100 hectares suitable for fertilization in 2008.

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1.0 Introduction

The impact of the Mountain Pine Beetle infestation throughout the forested Crown land of the British Columbia Interior is having significant short- and mid-term harvest supply impacts in management units predominated by lodgepole pine.

A financially viable method of improving timber supply in TFL 49 is to enhance the growth of other harvestable species such as Douglas-fir and Engelmann Spruce leading forested stands through fertilization.

The objectives of fertilization in TFL 49 include:

- To mitigate short- and mid-term timber supply impacts through strategically focused fertilization activities,
- To add merchantable volume to existing 25-85 year old stands to ensure earlier operability or contain higher volume when harvested. These treatments will mitigate mid-term timber supply impacts,
- To carry out viable investments in crown land to support both short- and mid-term employment.

Pre-planning is necessary to direct investments to stands which will benefit most from fertilization treatment and maximize financial returns to the Crown.

At the request of the Ministry of Forests and Range, Tolko Industries Ltd. – Okanagan Regional Woodlands has set up a fertilization implementation plan for TFL 49 in preparation for a fertilization program in 2008 – 2011 with the intent to mitigate mid-term harvest supply.

2.0 Background

This project will prepare a detailed implementation plan for the initiation of a broadcast fertilization program throughout suitable forested stands in TFL 49. The Ministry of Forests and Range has indicated its interest to expand the provincial fertilization program in the Interior. The intent is to mitigate the downward pressure on the BC interior forested land base affected by Mountain Pine Beetle.

Funding for this project is through the Ministry of Forests Forest Investment Account, Land Base Investment Program.

Preliminary analysis has identified 3,042 ha potentially suitable for fertilization in non-moisture limiting ecosystems. There is also an additional 500 ha of potential landbase falling under sub-hygric to hygric forested stands in the Okanagan Dry Belt. Approximately 201 ha of these stands fall within community watersheds.

3.0 TFL 49 Landbase

TFL 49 has a gross area of 144,541 ha of which 123,757 ha falls within the Timber Harvesting land Base (THLB).

Biogeoclimatic (BEC) subzones and variants suitable for fertilization treatment for Douglas Fir and Engelmann Spruce are shown in Table 1:

Table 1: Biogeoclimatic units within TFL 49

BEC Unit	Area (ha)
ESSFdc2	25,690
ICHmk1	8,168
MSdm2	55,007
TOTAL	88,865

4.0 Personnel and Equipment

The Ministry of Forests and Range Fertilization standards of April 1, 2007 provide clear direction of appropriate standards with respect to:

- Aircraft pilots
- Inspector's Qualifications
- Aircraft and Equipment

<http://www.for.gov.bc.ca/ftp/hfp/external/!publish/FIA%20Documents/standards/sdFS349a.pdf>

5.0 Silviculture Type 2 strategy

A Silviculture Type 2 Strategy was completed for TFL 49 by Forsite Consulting Ltd. on March 31, 2007. The recommendations identified that late rotation stands (41 – 75 years) and very late rotation stands (76-84 years) are suitable forested stand candidates for fertilization.

6.0 Incremental Silviculture

In general, incremental silviculture includes activities such as commercial thinning, juvenile spacing, pruning and fertilization which are not part of basic silviculture obligations required to establish a free growing forested stand following timber harvesting. Tolko is considering an incremental fertilization on TFL 49 in the short-term with the intent to mitigate downward pressures of mountain pine beetle impacts in the mid-term.

7.0 Site Productivity

The Silviculture Type 2 strategy identified average site productivity to be a site index of 14.9m based on the FC1 files. The current VRI (1998) records the Long Term Site Index at 18.7m.

Selection of candidate stands for fertilization will be consistent with the site selection guide (<http://www.forestsfortomorrow.ca/GuidelinesAndStandards/Fertilization/StandSelection.html>).

8.0 Eligible Stands

The Silviculture Type 2 strategy identified opportunities for fertilization in Douglas-Fir (Fd) and Engelmann spruce (Sx) eligible stands.

Existing Stands: Fd or Sx (not poor sites for Sx) leading stands in non-moisture limiting subzones (ESSFdc2, ICHmk1, and MSdm2 in TFL 49). Fertilization can be applied anytime between the ages of 40 to 89 years old. Pine should be avoided due to MPB impacts.

Post MPB Stands: Unsalvaged MPB impacted stands with less than 60% PI originally (i.e. 10-39% of the stand dead – 2000 series AU) will be eligible for fertilization (2000 series AU) because there are likely to be Fd or Sx leading now which have room for crown expansion and have enough residual stems to make it worthwhile.

Managed Stands: Fd, Sx or PI (future managed PI only) leading stands fitting the same age/BEC criteria above. Existing PI will be ignored, future managed PI will be eligible because it won't qualify for at least 15 years. Existing managed PI are ideal candidates to solve the mid-term trough, but they may be impacted by MPB and thus will be ignored.

Based on the above definition of eligible stands, the current THLB appears to have 6,974 ha of candidate areas (Table 2). However, the potential treatment option will increase as existing PI stands are turned into future managed stands through harvesting or stands move onto, post-MPB yields through succession. Refer to the candidate treatment maps for the location of candidate stands (Figure 1). The model will be given the option to fertilize candidate stands (and those that become candidate stands) throughout the planning horizon up to 1000 ha/year for all fertilization types.

Table 2: Candidate THLB stands for Early Rotation Fertilization on TFL 49 in 2008 / 09

Leading Species	Age Class	Area (ha) by BEC Variant			
		ESSF dc2	ICH mk1	MS dm2	Total
Fd	15-20		11	153	164
	21-40	5	6	242	253
	41-60		313	137	450
	61-80		219	437	656
	81-100		262	170	432
	101-120	1	494	496	991
Fd Total		6	1,305	1,635	2,946
Sx	15-20	645	126	1,044	1,815
	21-40	596	245	523	1,364
	41-60	18	24	11	53
	61-80	29	1	27	57
	81-100	16	2	86	104
	101-120	370	30	235	635
Sx Total		1,674	428	1,926	4,028
Total		1,680	1,733	3,561	6,974

Note: Green shading denotes primary candidates, yellow are secondary candidates

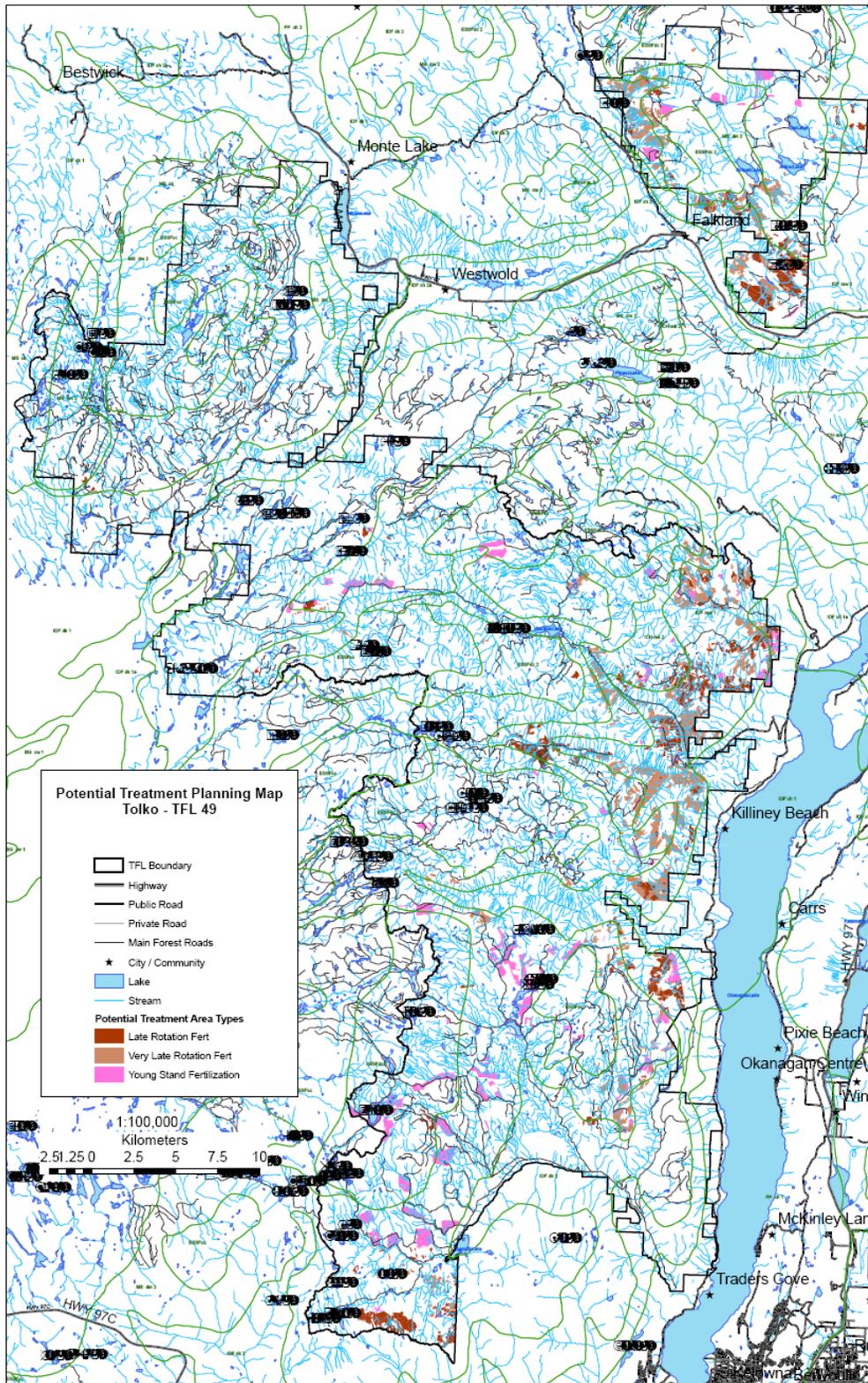


Figure 1: Potential fertilization sites on TFL 49

9.0 Targeted Forested Stands

The Forested stands targeted for broadcast fertilization treatments include Douglas Fir, Engelmann Spruce and Western Larch leading stands. Mixed stands with Fd and Sx leading species greater than 50% of the stand are also targeted forest stands.

Eight sites were viewed from the air; two of the sites could not be sampled due to budworm defoliation at the tops of the trees. In addition, four sites were not suitable for treatment due to inoperable terrain or presence on non target species (i.e. Balsam Fir (BI)).

Four of the eight sites sampled were deemed suitable, based on operability and having forested stands within the criteria for species composition, age and site index. Three of the four suitable sites are within a First Nation litigation area. This first analysis identified four sites suitable for a small scale fertilization program of 90.4 ha in 2008 (Table 3).

Table 3: Candidate Forest Stands targeted for fertilization in 2008

Site #	Forest Type	Mapsheet	General location	Polygon #	Forest Label	Site Index	Area (ha)	Foliar Samples
2008-01	Fd	82L.033	Lower Browns Creek	838/L	Fd 4301-20 sl	20	19.3	25
2008-15	Fd	82L.043	Spanish Lake	This area must be ground truthed & BEC verified			30	0 (budworm)
2008-17	Fd	82L.022	Whiteman's	4135	FdCw(SBI) 3206-20 L70#	20	37.5	0 (budworm)
TOTAL Fd							86.8	
2008-06	S	82L.023	Upper Browns Creek	466	SFd(CwPI) 3205-20 L70#	20	3.6	8
TOTAL S							3.6	
OVERALL TOTAL (ha)							90.4	

10.0 Foliar analysis

Foliar analysis was conducted in February 2008 on two forested sites in TFL 49 (Lower Browns Creek, Upper Browns Creek). Vegetation growth from the 2007 growing season was collected from the upper 1/3 of each sample tree and below the 3rd whorl from the top of the tree. Vegetation leaders were clipped manually using a helicopter and then bagged and tagged. GPS locations were collected for each stand.

A target of 25 foliar samples were collected at each stand and sent to the Provincial Analytical Chemistry laboratory in Victoria, B.C. Each sample from each forest stand will be amalgamated, and each aggregated sample will be dried and analyzed for nutrient content (N, P, K, Ca, Mg, total S, sulphate-S, Cu, Zn, Fe, Mn, B, and Al).

The results of the analysis have been reviewed with Rob Brockley of the MoFR to determine which nutrients are limiting and a prescription is then be prepared for each candidate forested stand.

10.1 Nutrient deficiencies

Foliar analysis of candidate stands has been completed on targeted stands and tested for nutrient content. Typically the stands in the Okanagan are deficient in nitrogen, boron

and active sulphates (Brockley, personal communication February 2008). The foliar analysis results confirmed that the sites tested are N deficient, micro nutrients were not limited (see Appendix 5)

10.2 Proposed fertilizer nutrient supply

The Ministry of Forests and Range Silviculture Branch tenders in March for fertilizer supply from BC distributors for delivery in October – November. A local distributor (Okanagan Fertilizer) in Enderby, B.C. has the capability to receive, mix and load trucks for delivery to forested sites in the Okanagan TSA. The contact number to Ken Clancy (Information and Sales for Okanagan Fertilizer) is 250-838-6414, or email ken@okfert.com.

10.3 Timing of Fertilizer Applications

Timing of both aerial and manual fertilization treatments is critical to the effective implementation of the fertilization program on TFL 49. For logistics reasons, application treatments should preferably be completed in snow free conditions, although applications may be completed with a snow cover.

10.3.1 Manual Treatments

Manual application will be delivered outside the heat of the summer, when soils are moist and there is good overnight recovery.

10.3.2 Aerial Application

Aerial applications of fertilizer will be conducted in the fall or spring when soils are moist and there is good overnight recovery.

10.4 Fertilization Return on Investment

The inventory of forested polygons which show potential for late rotation fertilization treatments will each undergo a business review as per the parameters provided by the Ministry of Forests and Range consistent with Stand Selection Guidelines for Fertilization 2006. The stand selection criteria indicates that fertilizer response is expected on all Fd sites and on Sx sites with site index between 15 and 24. All stands selected meet this criteria.

Further fertilization planning on forested stands not meeting the eligibility criteria will cease.

The results of the eligibility review by polygon opening are shown in Table 4.

Table 4: Return on Investment of fertilization treatment of proposed forest stands

Forest Site #	Geographic Location Mapsheet-polygon	Community Watershed (Yes/No)	Species	Age	Area (Ha)	Return on Investment
2008-01	82L.033 838-L	No	Fd	78	19.3	Yes
2008-06	82L.033 466	No	SFd(CwPI)	55	3.6	Yes
2008-15	82L.043	No	Must be ground truthed		30.0	N/A
2008-17	82L022 4135	No	FdCw(SBI)	55	37.5	Yes
TOTAL					90.4	

11.0 Budget

The budget for this plan inclusive of foliar analysis of vegetation collected from forested stands in February 2008 is \$36,996 (\$32,900 + delivery allowance) (Table 5).

The quantity of suitable forested stands to recommend for forest fertilization will be limited to sites that can be field checked over a two day period by helicopter access and to which the foliage analysis identifies cost effective delivery of the program. An estimate of 4000 ha is being used for this initial estimate.

Table 5: Budgetary summary for fertilization work in TFL 49

Description	Contractor	Qty	Unit	Rate (\$)	Total (\$)
Phase 1					
Sample Plan analysis	TFMG	12	hr	80	960
Phase 2					
Field sampling	Terrafor	4	hr	50	200
Foliage sampling planning	Terrafor	2	md	400	800
Helicopter (wet)	Canadian	18	hrs	1,330	24,000
Sampling Crew (2)	Bridge	16	hrs	80	1,280
Pickup	Bridge	500	km	0.61	305
Field Expenses per diem	Bridge	6	lump	47.50	285
Qualitative Analysis & Report	Lab	16	samples	60	960
Phase 3					
Fertilization Implementation Plan	TFMG	15	hr	80	1,210
Supervision	Terrafor	5	md	580	2,900
Sub- total					32,900
Delivery allowance					4,096
TOTAL					\$36,996

12.0 Water Quality Concerns

The Fertilization Standards (April 1, 2007) provide clear direction for operational requirements to address water quality concerns.

The Forest Practices Code Fertilization Handbook 1996 provides guidelines to consider for the implementation of a fertilization program.

In community watersheds, baseline water quality data should be secured from Ministry of Environment prior to fertilizer applications. FRPA Regulation requires water quality baselines prior to implementation of fertilizer application in community watersheds.

Monitoring water quality before and after broadcast forest fertilization is recommended in all community watersheds. The monitoring is the responsibility of the person applying the fertilizer. The following guidelines are recommended:

12.1 Water Quality Monitoring

The *Forest Practices Code of British Columbia Act* and regulations refer to protecting water quality. Water quality monitoring is needed to ensure the effective protection of water quality. This section outlines some approaches to water quality monitoring, within community watersheds.

Requirements:

Forest Fertilization Guidebook - Appendix 4: Water sampling guidelines for community watersheds and designated fish streams

<http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/fert/app4.htm>

Water quality monitoring:

Water quality monitoring before and after broadcast forest fertilization is recommended in all community watersheds and recommended in contentious or fisheries-sensitive areas planned for fertilizer applications. In sensitive areas such as salmon spawning streams, changes in water chemical composition may negatively impact biological productivity. If there are any doubts whether water sampling should be conducted, please contact the B.C. Ministry of Forests for recommendations. The following guidelines are adapted from the *Community Watershed Guidebook: Forest Fertilizers*. These guidelines are recommended for water quality monitoring:

A. Sample sites

Choose 2 sampling sites, one upstream from the treatment area serving as the control and the other immediately downstream of the treatment area. Sampling in these locations should provide an indication of the maximum concentrations of chemicals due to fertilizer application. More sites should be selected if the treatment area covers a large area.

Sample sites should be located accurately. Only if the same location is consistently sampled can temporal changes in water quality be interpreted with confidence. Use

accurately written station location descriptions, mark the sites in the field with flagging, and locate them on maps.

B. Sampling procedures

Use clean bottles and obtain water samples as close to mid-stream and mid-depth as practically possible. If sampling in a fish stream, take the water temperature at the sampling location. Temperature is necessary to assess ammonia levels. Label the bottles with the date, site location, and water temperature (if necessary).

Samples must be shipped on the day of collection in a cooler packed with ice, in order to maintain a sample temperature of approximately 4°C. The samples must be received by the laboratory within 72 hours of collection.

C. Sample frequency

Pre-application monitoring should be conducted for two weeks. Obtain three samples, twice per week at both control and treatment area sites. Obtain results back from the laboratory in a timely manner to enable changes to be made in the planned treatments if the analysis shows high levels of natural nitrogen or phosphorus.

Post-application monitoring should be conducted immediately following fertilizer application and then twice per week for three weeks. Also, if a storm event occurs during the three weeks post-treatment period, obtain water samples within 24 hours of the event. This will provide an indication on increased nutrient inputs through direct application to streams or through accidental spills.

Collect at least one sample approximately three months after fertilizer application, to document water quality returning to background levels. In the interior of British Columbia, at least one sample should also be collected immediately after spring floods.

D. Laboratory analysis

For both community watersheds and fish-sensitive streams, total dissolved phosphorus should be analyzed if phosphorus was present in the fertilizer mix. Samples must be shipped on the day of collection, and results received back from the laboratory as quickly as possible, preferably within 3 days.

Community watershed

Pre- and post-monitoring samples should be analyzed for pH, total nitrogen, total ammonia, and nitrate-N.

Fish streams

Pre- and post-monitoring samples should be analyzed for pH, total ammonia and nitrite-N.

E. Analysis of concentrations

Community watershed

Post-treatment monitoring results exceeding levels specified in this guidebook should be reported promptly to the Ministry of Health; the water purveyor; Ministry of Environment, Lands and Parks; and the district silviculture resource officer, Ministry of Forests. These results should then be used to guide future applications.

Fish streams

Pre-treatment results that exceed the following thresholds for ammonia or nitrite-N are not recommended areas for aerial fertilization. Post-treatment results that exceed the threshold levels should be reported to the district silviculture resource officer, Ministry of Forests, and the Department of Fisheries and Oceans (DFO).

Nitrite-N should not exceed 0.06 milligrams/litre.

Recommended maximum levels for total ammonia (NH₃) (from CCREM, 1987)

The application of phosphorus-based fertilizer should not result in detectable elevations of total phosphorus over background stream concentrations when appropriate streamside buffer zones are used. Detectable elevations should be reported to the district silviculture resource officer, the regional environmental section head for the MoELP, and the DFO.

F. Water Quality Branch, Ministry of Environment, Lands and Parks

The Environmental Protection Department of the Ministry of Environment, Lands and Parks operates a water quality program, and can be contacted for assistance with water quality monitoring in community watersheds. For information, contact:

Water Quality Branch
Environmental Protection Department
Ministry of Environment, Lands and Parks
765 Broughton Street
Victoria, B.C., V8V 1X4

13.0 Fertilizers

Forest fertilization must not cause water quality to fall below any water quality objectives established by the Ministry of Environment, Lands and Parks.

Application of fertilizer in a community watershed must not cause:

- nitrate-N levels in a stream to exceed 10 mg/L measured below the area where the fertilizer is applied, or 1 mg/L measured at the community water supply water intake
- chlorophyll-a levels to exceed more than 2 µg/L in a lake or 50 mg/m² in a stream.

For more information on project-specific monitoring of forest fertilizer use, see section 13.1 "Forest fertilizer management."

13.1 Forest Fertilizer Management

The *Forest Fertilization Guidebook* describes detailed planning and operational guidelines for forest fertilization programs and should be read in conjunction with the following guidelines.

There are two principal concerns with fertilizers applied in a community watershed:

- Directly or indirectly contaminating the community water supply with increased nitrogen and phosphorus, either through broadcasting fertilizer directly onto streams during aerial application or by indirect seepage into streams,
- Triggering algae production in lakes, reservoirs and streams, with a consequent reduction in water quality as a result of increased nutrients from fertilization.

Requirements:

- A 10 m fertilizer-free zone (FFZ) must be maintained around any flowing stream that is observable from the air in a community watershed.
- Forest fertilizers must not be applied within 100 m upslope of a community water supply intake.
- Applications of forest fertilizers in a community watershed must not cause a deterioration in water quality immediately below the treatment area or at the intake.

Target conditions:

Attribute	Target condition
fertilizers detected near streams	• a 10 m FFZ around all visible streams
fertilizers near intake	• a 100 m FFZ around intakes
nitrate levels in streams	• maximum 10 ppm increase below treatment area • maximum 1 ppm increase at intake
chlorophyll-a levels in lakes	• maximum 2 µg/L (summer mean for surface waters)
chlorophyll-a levels in streams ⁷	• maximum 50 mg/m ²

<http://www.for.gov.bc.ca/tasb/legsregs/fpc/FPCGUIDE/WATRSHED/target7.htm>

13.2 Types of Fertilizers

13.2.1 Biosolids

Biosolids from treated waste water sewage should not be applied in community watersheds.

13.2.2 Chemical Fertilizers

Forestry grade **urea (46-0-0)** and **ammonium sulphate (35-0-0-10)** are the only fertilizers that have been specifically tested for trace element content to the satisfaction of the British Columbia Ministry of Health. They are the only

formulation that is recommended for application in community watersheds. As other formulations are tested and approved by the Ministry of Health, they will be added to the list of acceptable fertilizers.

13.3 Planning

Notify the water purveyor of the times when fertilizers will be applied in the watershed.

Broadcast fertilization is not recommended in community watersheds with high natural nutrient levels in streams or lakes. If the additional nutrient input from forest fertilization may result in increased production of periphytic algae, fertilization should not take place. The growth of algae is primarily limited by phosphorus, or is co-limited by both nitrogen and phosphorus. Phosphorus is generally not available in soils in coastal watersheds, and as long as phosphorus is not applied in fertilizers, algae problems are unlikely. Some interior streams and lakes have higher natural phosphorus levels, and as a result, they are susceptible to a reduction in water quality through increased nitrogen availability after forest fertilization. These watersheds include those with natural, pre-treatment water quality parameters of:

- a lake or reservoir with a nitrogen/phosphorus ratio less than 15:1
- natural nitrate levels of greater than 1 mg/L in lakes, or of greater than 2 mg/L in streams
- phosphorus levels in streams or lakes of greater than 10 µg/L
- natural algae production (chlorophyll-a of greater than 50 mg/m² in streams, or of > 2 µg/L in lakes.

The proponent is responsible for pre-treatment and post-treatment water sampling. All samples are to be taken in the same season that fertilizer is applied. Samples are to be measured for nitrate, ammonia, and total dissolved phosphorus.

13.4 Timing and extent of fertilizer application

- Apply urea in cool and moist conditions (October–March), but not when soils are saturated and heavy rain is occurring or is forecast within the next few days. Timing is a balancing act between volatilization and creating high fertilizer run-off conditions.
- In watersheds with lakes or reservoirs, fertilizers should not be applied during the spring or early summer, when algae blooms in lakes or reservoirs as a result of rising water temperatures and available nutrients may be increasing. In general, this can occur during the following periods:
 - Application in Okanagan Should occur between September 15 – May 15th

13.5 Maximum Treatment Areas

- Up to 30 per cent of the watershed area could be treated in any 12-month period, provided that a fertilizer-free zone can be maintained around all flowing streams visible from the air.
- If a fertilizer-free zone cannot be maintained around at least 75 per cent of the total length of flowing streams, no more than 12 per cent of a watershed shall be fertilized. Monitoring results have shown that if less than 12 per cent of a watershed is treated, measurable levels of nitrate-N will not be detected below the treatment area.

13.6 Mapping Streams

- Maintain a 10 m fertilizer-free zone (FFZ) around all streams observable from the air.
- Map all streams in the proposed cutblock at a map scale of not less than 1:20 000 before applying fertilizer. In addition to the streams normally shown on maps of this scale, all other streams that can be observed from aerial photographs and from preliminary reconnaissance helicopter flights of the area should be sketched in. Use these maps to plan flight lines.
- Recognition of small streams from helicopters can be difficult in advanced second growth. Often they are more evident on air photos than they are from low-flying helicopters. Historical air photos can also be used to demarcate streams, that would have been more evident at earlier seral stages.
- If advanced second growth makes recognizing flowing streams very difficult and unreliable, do not treat more than 12 per cent of the watershed area in any single application, to protect water quality.

13.7 Flight lines

- Treatment boundaries should eliminate streams from the treatment block.
- Flight lines should run parallel to the stream or water body and should be laid out. This will provide a buffer before the fertilizer is applied to the remainder of the block (Figure 2).
- Plan flight lines so that there is a 10 m fertilizer-free zone (FFZ) around all streams. For example, a 60 m application swath (30 m either side of the flight line, Figure 3), will ensure that there is a minimum 10 m FFZ. This minimum setback should be applied to all streams, regardless of whether they have a riparian reserve.

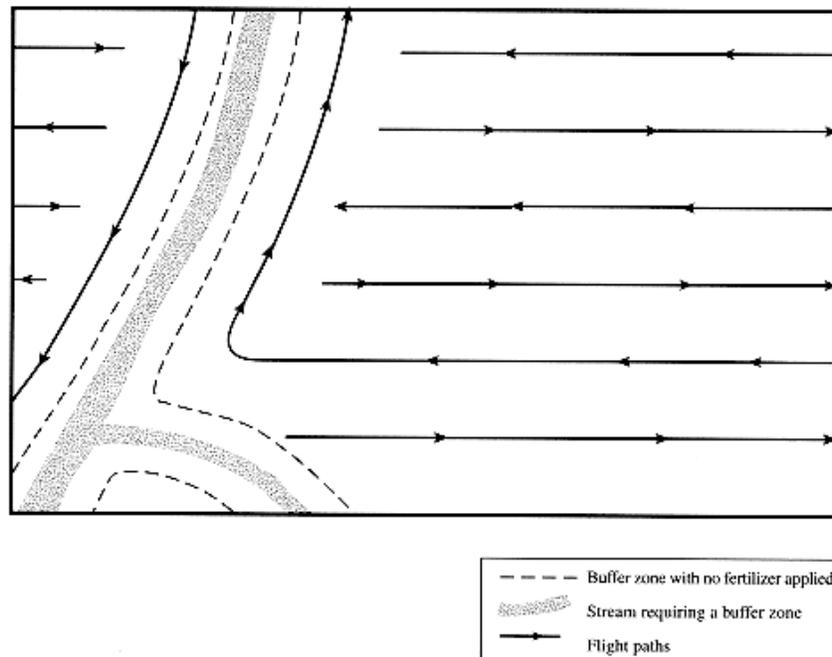


Figure 2: Strategy for laying out a buffer zone to protect a stream flowing through an area proposed for fertilization.

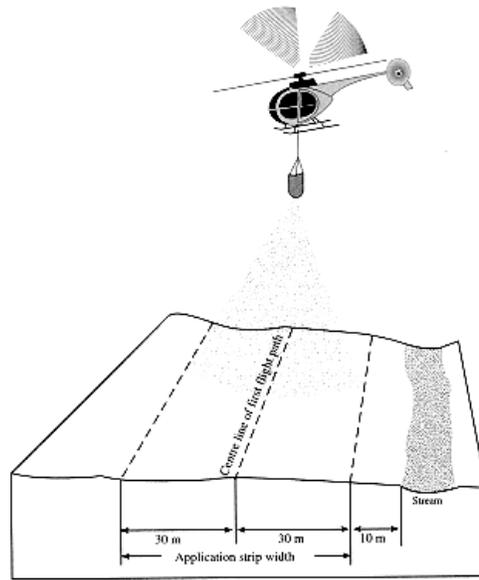


Figure 3: Strategy for 10 m buffer zone for no fertilizer application along a creek.

13.8 Fertilizer-free zones

- A fertilizer-free zone (FFZ) is the band around any flowing stream, where the intent is to keep the zone free of fertilizers. Because some fertilizer pellets will inadvertently enter this zone, it is not strictly "fertilizer-free," but the intent is to prevent fertilizers from being applied anywhere in the zone.
- Treat riparian reserve zones as fertilizer-free zones. Every community watershed stream greater than 1.5 m wide has a minimum 10 m riparian reserve zone, and streams wider than 5 m have wider reserves. There is no benefit in fertilizing these no-harvest areas.
- Watersheds that are not nutrient sensitive require a 10 m fertilizer-free zone around all flowing streams that are observable from the air, and it is desirable to maintain a minimum 10 m fertilizer-free zone around all streams.
- Fertilizing is not recommended for nutrient sensitive watersheds.
- If fertilizing does take place in sensitive watersheds, increase the FFZ to 30 m around all streams that are observable from the air.
- A 100 m FFZ must be maintained upslope and upstream of any community watershed intake. Refer to section 2.3.1 "Location of water intakes" for information on determining the location of the water intake.

13.9 Material handling

Heliports should not be located within community watersheds. However, if they are, the following guidelines apply.

- Locate heliports in dry areas, well removed from ditches or natural water bodies.
- Direct any surface drainage through heliports away from ditches or streams.
- Clean up loading sites daily to prevent accidental exposure to concentrated amounts of fertilizer.
- Ensure that the contract contains a contingency plan that specifies the remediation of accidental spills.

14.0 Accidental spills

Clean up all spills, on land or into water, immediately.

Before beginning any fertilizer program, prepare a contingency plan and have the district manager approve in case of accidental spills of fertilizer into a water course. The plan should include but not be limited to:

- names and telephone numbers of emergency contacts in the Ministry of Health, Ministry of Forests, Ministry of Environment, Lands and Parks, and the water purveyor
- a plan for an alternate water supply until water quality in the affected area returns to normal (the need for alternate supplies will be determined by the medical health officer)
- a water quality monitoring program to document the return of water quality to a level acceptable to the Ministry of Health
- accident clean-up procedures, including remediation of the site and disposing of spill material.

15.0 Permits and Approvals

Tolko will conduct all works in accordance to the necessary permits required for:

1. Free Use Permit for the collection of vegetative Scions to conduct foliar analysis to determine the preferred mix of nutrients to be applied through the fertilization program.
2. General Standards for Ministry of forests and Range funded program (April 1, 2007)
3. Standards for the application of a fertilizer in Community watersheds and non Community watershed in the TFL49 and consistent with the Ministry of Forests and Range Fertilization Standards (April 1, 2007) as available on the Forest for Tomorrow website
<http://www.for.gov.bc.ca/ftp/hfp/external!/publish/FIA%20Documents/standards/sdFS349a.pdf>
4. Project delivery consistent the Ministry of Forests and Range Fertilization Standards (April 1, 2007) as available on the Forest for Tomorrow website
<http://www.for.gov.bc.ca/ftp/hfp/external!/publish/FIA%20Documents/Standards/FS1001.pdf>

16.0 Referrals

16.1 First Nations

Communication and information sharing with First Nations is critical through the fertilization planning process.

Tolko will ensure that the Okanagan Nation Alliance (ONA) representing 7 Okanagan bands and the Shuswap Nation Tribal Council (SNTC) representing the four Shuswap Indian Bands will be contacted and brought aware of any forthcoming fertilization program. Tolko will also communicate and share information with those Bands directly affected by the proposed treatments.

Both the ONA and SNTC will participate with the Okanagan Innovative Forestry Society's technical sub committee to identify fertilization priorities throughout the TSA.

16.2 Ministry of Environment

Region	Title	Name	Phone #
Kamloops	Sr. Ecosystem biologist	Michael Burwash	250.371.6269
Kamloops	Fish & Wildlife	Rob Biso	250.371.6244
Penticton	Fish & Wildlife	Steven Mathews	250.490.8243
Vernon	Ecosystem Biologist	Brian Robertson	250.260.3040

16.3 Ministry of Environment Water Stewardship

Region	Title	Name	Phone #
Okanagan	Source Water Protection Hydrologist	Solvei Patschke	250.490.2217

16.4 Ministry of Forests and Range

Region	Title	Name	Phone #
Southern Interior	Stewardship	Al Randall	250.828.4183
Okanagan Shuswap Forest District	Stewardship	Keith Boyes	250.558.1778
Okanagan Shuswap Forest District	First Nations	Laverne Cormier	250.260.4603
Okanagan Shuswap Forest District	Range Officer	Vic Wright	250.558.1787
Forests Research Branch	Researcher	Rob Brockley	250.260.4755

16.5 Range Tenure Holders

Urea fertilization may be toxic to cattle when consumed in significant amounts. Affected range tenure holders will be informed of proposed applications, the timing of such applications, and the measures taken to prevent exposure to cattle.

17.0 Standards

- Fertilization Standards for Ministry funded programs (April 1 2007) as published on FFT website (Appendix 1)
- Interim Guidance for First Nations' Consultation Matrix – December 2007

18.0 References

Forest Fertilization Guidebook (1995) Ministry of Forests & Ministry of Environment

Community Watershed Guidebook (1996) Ministry of Forests & Ministry of Environment

Evaluating Forest Stand Nutrient Status (1986) Ministry of Forests, Land Management Report 20 ISSN 0702-9861. March 1986

APPENDIX 1 : Forest Fertilization Standards April 1, 2007

Forest Investment Account

Ministry of
Forests and
Range



**Fertilization Standards
for Ministry funded Programs
Effective April 1, 2007**

These standards apply, in addition to the [General Standards for Ministry funded Programs \(FS-1001\)](#), to all planting activities funded under Ministry funded Programs.

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ARTICLE 1: DEFINITIONS

1.1 In this document, the following words shall have the following meanings.

"Approved Fertilization Quality Inspection System" means the Fertilization Quality Inspection system contained in this document or another similar system approved in writing by the District Manager prior to the commencement of Work.

"Buffer Zone" means an area established between an area to be fertilized and an area which must not be fertilized or have fertilizer enter into it.

"Contingency Plan" means a plan prepared in accordance with Article 4 of this document, to be implemented in the event of a fertilizer spill, accident or misapplication.

"No Treatment Zone" means an area within which no fertilizing takes place.

"Water Quality Limits" means

- (a) 10 ppm nitrate nitrogen in a stream immediately below the area where fertilizer has been applied;
- (b) 2 micrograms/litre of chlorophyll in a lake;
- (c) 50 milligrams/square metre of chlorophyll in a stream; or
- (d) any known water quality standard or objective which is or can be expressed in terms of a maximum permissible



ARTICLE 2: PERSONNEL & EQUIPMENT

Aircraft Pilots

- 2.1 Pilots for the fertilizer application must, in addition to holding valid Commercial Pilot's Licences and any required federal/provincial licences and certificates, have demonstrated ability and experience in applying fertilizer in forest situations. No pilot may make an operational flight without direct supervision unless he or she has successfully applied fertilizer to a minimum of one thousand (1 000) hectares of forest land under the supervision of experienced pilots.
- 2.2 In the event that a substitution of a pilot is required, the substitute must meet the Ministry Standards. The substitute pilot must carry out a reconnaissance flight of the Work Areas prior to the commencement of fertilizer application.
- 2.3 The project supervisor must not be the pilot for the operation.

Inspector's Qualifications

- 2.4 All Work must be inspected by a person (the "inspector") who is:
- (a) the Registered Professional Forester (RPF), or operates under the direction of the RPF, who will sign and professionally seal reports for the Work;
 - (b) experienced and competent in conducting inspections of fertilizer operations;
 - (c) familiar with the Treatment Plans and Work Plans for the Work Areas; and
 - (d) not engaged in the direct conduct of the fertilizer operations.

Aircraft and Equipment

- 2.5 The aircraft and specialty equipment and services used in fertilizer application must have all necessary approvals and certificates in good standing and must be equipped and operated in accordance with the laws and regulations of Canada and the Province of British Columbia.
- 2.6 Aircraft carrying persons employed by or acting as agents of the Province must have the appropriate approvals as determined by the aircraft's flight manual and certificate of airworthiness.

ARTICLE 3: FERTILIZER

Provision of Fertilizer

- 3.1 Fertilizer must be of the Specified types and quantities.

Handling and Storage of Fertilizer

- 3.2 Equipment and supplies at the Work Area or loading site must be secured to prevent unauthorized access to the fertilizer.
- 3.3 Fertilizer must be loaded into the dispensing equipment only in locations where spilled fertilizer cannot enter a water body or other non-target area.
- 3.4 Tanks, buckets and other dispensing equipment must not be washed in or near streams, rivers or lakes.

ARTICLE 4: PRE-OPERATIONS REQUIREMENTS

Work Plans

- 4.1 Where any of the following is not specified in a Treatment Plan for fertilization it must be specified in a Work Plan:

- (a) by Treatment Unit
 - i) the type and total amount of fertilizer to be applied,
 - ii) the fertilizer application rate,
 - iii) the application method,
 - iv) the season or timing of application;
- (b) a written fertilizer operations plan which must include
 - i) the location of helispots, airstrips, and loading sites,
 - ii) a schedule of fertilizer application to the Work Areas,
 - iii) aircraft ferrying routes between the staging areas and the Work Areas so as to minimize flights over major aquatic systems and to avoid human residences,
 - iv) the location of Buffer Zones around watercourses, waterbodies, No-treatment Zones, or other specified areas to be avoided, sufficient to ensure fertilizer does not enter them,
 - v) a water quality monitoring plan, if appropriate to the water resource of the Work Area,
 - vi) the requirement, if any, to mark boundaries of the Work Areas or Buffer Zones,
 - vii) radio frequencies to be used during operations,
 - viii) the visual signal system to be used for emergencies (e.g., smoke bombs, vehicles, lights and flags),
 - ix) the need for and methods of controlling public access,
 - x) disposal procedures for fertilizer containers, bags and other waste material;
- (c) a Contingency Plan in the event of fertilizer spill, accident or misapplication which must include, but is not limited to
 - i) a description of the types of spill or events requiring immediate action,
 - ii) the names and telephone numbers of emergency contacts,
 - iii) water quality monitoring to be instituted in the event of a spill or misapplication in or near a water body,
 - iv) accident clean up procedures, and
 - v) disposal of spill materials;
- (d) other scheduling requirements and conditions as deemed necessary by the District Manager.

4.2 A Work Plan must:

- (a) Show No-treatment Zones where they are needed to provide protection as required under sections 57 and 59 of the *Forest Planning and Practices Regulation*.
- (b) provide for water quality sampling in accordance with the *Forest Fertilization Guidebook* where fertilization is to take place in a community watershed.

Layout

- 4.3 The District Manager may at any time require the Recipient to identify and flag on the ground the boundaries of Work Areas, Buffer Zones and No Treatment Zones.

Safety

- 4.4 The Recipient bears all responsibility for safe operations.
- 4.5 Prior to the commencement of fertilizer application, helispots and/or airstrips must be confirmed as safe for use by the fertilizer application aircraft and support equipment. Minor improvements may be made before or after commencement of operations without having to obtain the approval of the District Manager. For the purposes of this section, minor improvements are defined as cutting and removing brush and non-crop trees less than five metres in height occupying landings or old road beds on an area not exceeding one tenth of a hectare.
- 4.6 If there is a need to fall snags or other trees on a Work Area to meet safety or operational requirements, a plan must be submitted to the District Manager at least five Work Days prior to commencing operations.

ARTICLE 5: FERTILIZER OPERATIONS**General Requirements**

- 5.1 All fertilizer application shall be in accordance with the Ministry Standards, including any standards or specifications stated or implied in the Approved Fertilization Quality Inspection System which forms part the Ministry Standards.
- 5.2 Despite any requirement that is Specified on a per hectare basis, all fertilizing requirements must be met throughout the entire Work Area, so that fertilizer is as evenly applied as possible.
- 5.3 The following documents must be on site at all times:
- (a) a copy of the Fertilization Standards;
 - (b) Material Safety Data Sheets (MSDS) of the fertilizers being applied; and
 - (c) the Work Plan.
- 5.4 The equipment, including vehicles for hauling fertilizer, must not cause unacceptable site disturbance to a Work Area or road.
- 5.5 Ministry of Forests employees or agents must not be permitted in an aircraft applying fertilizer.
- 5.6 Fertilizer must not be applied to a No Treatment Zone, a Buffer Zone or outside a Treatment Unit.

Notification of Operations Start-up

- 5.7 The Recipient must notify the District Manager of its intended commencement of operations within a community watershed at least one Work Day in advance.

Roads

- 5.8 When fertilizing near a road, all necessary precautions must be taken to ensure the safety of road users. Where necessary, information signs must be posted along roads and flag persons supplied to coordinate traffic.

Requirement to Stop Operations

- 5.9 Fertilizer application operations must be stopped when:
- (a) there is inadequate daylight for safe application;
 - (b) weather conditions arise which could adversely affect normal application patterns, safety of application, or treatment effectiveness;
 - (c) a leak and/or spill of chemicals occurs (such as fertilizers, oils and fuel); or
 - (d) there is a breakdown in ground-based communications;
- until such time as the condition causing the stoppage changes or is rectified.

Leakage, Spills and Accidents

- 5.10 In the event of a fertilizer spill or misapplication into non-target areas (e.g. water bodies), operations must be stopped and the Contingency Plan immediately implemented.
- 5.11 Leaks and/or spills of chemicals (such as fertilizers, oils and fuel) must be cleaned up and disposed of in accordance with provincial laws and regulations prior to the resumption of fertilizer application.
- 5.12 Fertilizer spilled at the loading or worksite in the normal course of operations and not considered an emergency under the Contingency Plan must be cleaned up the same day.

Site Clean-up & Repair

- 5.13 Upon completion of fertilizer operations:
- (a) all unused fertilizer must be removed from Crown land;

- (b) fertilizer containers or bags and any other waste material must be removed from Crown land and disposed of in accordance with the Work Plan;
- (c) any damage to a Work Area must be repaired; and
- (d) any remaining spilled fertilizer must be removed.

ARTICLE 6: INSPECTION & NOTIFICATION

Fertilization Quality Inspection

- 6.1 The Inspector must inspect the Work in accordance with an Approved Fertilization Quality Inspection System in a timely manner to ensure all Work is performed to the Ministry Standards.
- 6.2 Unless otherwise approved by the District Manager, the methodology contained in this Article shall form the basis for the Approved Fertilization Quality Inspection System.
- 6.3 The Inspector shall:
 - (a) visually check No-treatment Zones and water bodies for the presence of fertilizer, and
 - (b) undertake such checks and observations as are necessary to be able to declare an area satisfactorily treated as described in the following section.

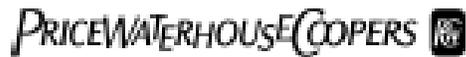
Determination of Satisfactory Treatment

- 6.4 The Inspector may declare an area satisfactorily treated if all Work has been performed in accordance with the Ministry Standards, Treatment Plans and Work Plans, particularly:
 - (a) the entire area has been treated satisfactorily;
 - (b) the required volume, plus or minus ten percent, and type of fertilizer has been applied; and
 - (c) operational monitoring confirms
 - i) the fertilizer application system was properly calibrated,
 - ii) the required swath widths and volume delivery per hectare were achieved,
 - iii) compliance with the application procedures,
 - iv) water quality monitoring procedures carried out during application were appropriate to the stream and water resources of the Work Areas; and
 - (d) Water Quality Limits were not exceeded for a period of up to three weeks following fertilization.

Requirement to Notify the District Manager

- 6.5 Further to the notification requirements contained in the [General Standards for Ministry funded Programs \(FS 1001\)](#), a Recipient must immediately notify the District Manager whenever:
 - (a) an inspection indicates an area greater than one (1) hectare has not been satisfactorily treated (or other minimum area that may be Specified by the District Manager) and the Recipient is unable to rectify the deficiency;
 - (b) fertilizer has been applied, has entered, or is likely to enter a water body, a No-treatment Zone, or an area outside of a Work Area;
 - (c) fertilizer is spilled, other than minor spills in the normal course of operations and which are not considered under the Contingency Plan as requiring immediate action;
 - (d) a Water Quality Limit has been exceeded; or
 - (e) an accident involving aircraft occurs.
- 6.6 Any notification under the previous section must be followed by written notice within one Work Day.
- 6.7 Where an aircraft is involved in an accident, the Recipient must also notify Transport Canada and the Aviation Operations Section of the Ministry of Forests, Victoria.

APPENDIX 2 : Interim Guidance for First Nations' Consultation Matrix



FOREST INVESTMENT ACCOUNT

FIA UPDATE – December 21, 2007

Interim Guidance for First Nations' Consultation Matrix

The Ministry of Forests and Range ("MFR") has requested PricewaterhouseCoopers ("PwC") provide Land Base Investment Program ("LBIP") Recipients a copy of the attached *Interim Guidance for First Nations' Consultation* matrix that has been sent to the MFR District Managers as a guide in their reviews of LBIP activities in relation to whether the First Nation consultation process, including the information sharing step, has been appropriate. This matrix was developed following several discussions within the MFR, including a MFR LBIP regional representative meeting in October 2007.

The purpose of the matrix is to reach agreements with First Nations and to acknowledge specific consultation requirements. The three main points listed below guide the use of the matrix by the District Manager:

- 1) Act as a strategic guide for consultation processes in the MFR. The matrix would assist the MFR in making assessments of where to focus limited resources while fulfilling its legal obligations.
- 2) Act as a communication tool with First Nations. The matrix is a discussion tool which could be used to develop a common and collaborative consultation approach with First Nations, in the spirit of the New Relationship.
- 3) Act as a guide to making Forest and Range Opportunity ("FRO") implementation more efficient. The matrix would be discussed during the FRO negotiation and would then become part of the consultation process agreed to in the agreement. "

This new FIA LBIP information sharing/consultation section for the matrix will fit with the first two purpose statements above, and will be used with the FIA LBIP Land Base Investment Rationales and information sharing process, found at:
<http://www.for.gov.bc.ca/hcp/fia/landbase/LBIPRationale.pdf>

Recipients are also asked to remember that the consultation spectrum is negotiable with the First Nation. The numbers shown in the matrix are a recommendation and thus the applicability to all First Nations cannot be inferred. The level will depend on what/how the potentially affected First Nation wants to undertake consultation for the particular decision at hand. Recipients are reminded to work with the District Manager to determine the requirements of their own specific situations.

Please call your Investment Manager at (604) 484-3490 if you have any questions or need further clarification in regards to any aspect of this update or the LBIP.

**MINISTRY OF FORESTS AND RANGE
NON-STATUTORY DECISIONS FOR THE
FOREST INVESTMENT ACCOUNT LAND BASE INVESTMENT PROGRAM**

For the Forest Investment Account (FIA) – Land Base Investment Program (LBIP), “third party” information sharing activities are undertaken by the program Recipient agreement holders. The Ministry of Forests and Range (MFR) District Manager or designate has decision making authority as to whether the First Nation consultation process, including the information sharing step, has been appropriate.

FIA LBIP Recipients will provide the District with a proposed list of eligible activities (within the Land Base Investment Rationale document) in order to receive direction from District on the appropriate level of information sharing. After the Recipient has completed the information sharing process, the District Manager or designate will determine and document whether the information sharing has been adequate.

In the LBIP, the majority of the projects undertaken by Recipients involve activities such as strategic resource planning and the gathering of resource information which will likely have minimal impact on the land base. Some of the funding is invested each year in projects that are “on the ground” and are more likely to directly impact the land base (e.g., road deactivation, stream restoration).

Activity Description	Category	Responsibility			Consultation spectrum #	PROPOSED INFORMATION SHARING/CONSULTATION ACTION
		DDM Office	Program	Lead - Information Sharing		
FIA LBIP - Strategic Resource Planning Component	A	D	F	R		
89. Land Base Investment Rationale					2	Available on request. Provides overview of management unit issues and eligible activities, some of which may require additional detail or additional information sharing and Crown consultation e.g., stand treatments, road deactivation.

1. Planning- FN involvement 2. Available on Request 3. Notification 4. Expedited process 5. Normal Course Consultation: Inform & follow-up 6. Deep consultation

Activity Description	Category	Responsibility				Consultation spectrum #	PROPOSED INFORMATION SHARING/CONSULTATION ACTION
95. Stand Treatments to meet timber objectives (fertilization)						3/5-6	Notification/Crown consultation. Level of information sharing and Crown consultation may vary depending upon the activity being proposed.
96. Stand Treatments to meet non-timber objectives (treatments e.g., pruning trees or shrubs for forage production, and treatment effectiveness evaluation)						2-3	Available on request/notification.
97. Current Fire and Pest Reforestation (surveys, site preparation, planting, brushing)						2-3	Available on request/notification.
98. Forest Health (surveys, pruning, spacing, pheromone baiting for bark beetles, invasive plant treatments)						2-3	Available on request/notification.
FIA LBIP – Infrastructure Component	O	D	F	R			
99. Recreation (site and trail maintenance)						2	Available on request.
100. Environmental maintenance on non-status Forest Roads (access management planning and prioritizing; project plan including inspection and maintenance report, design, or prescriptions; major works; and follow-up inspections.						2-3/5	Available on request/notification/normal course Crown consultation. Level of information sharing and Crown consultation may vary depending upon the activity being proposed.

A=Administrative, O = Operational, D=District, F=Forest Investment Account, R=FIA LBIP Recipient

1. Planning- FN involvement	2. Available on Request	3. Notification	4. Expedited process	5. Normal Course Consultation: Inform & follow-up	6. Deep consultation
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Activity Description	Category	Responsibility			Consultation spectrum #	PROPOSED INFORMATION SHARING/ CONSULTATION ACTION
FIA LBIP - Restoration and Rehabilitation Component	O	D	F	L		
101. Aquatic (in-stream structures and treatments, restoration of fish passage, treatment effectiveness evaluation, inspection and maintenance)					3/5	Notification /normal course Crown consultation. Level of information sharing and Crown consultation may vary depending upon the activity being proposed.
102. Riparian (treatments, treatment effectiveness evaluation, inspection and maintenance)					3/5	Notification/normal course Crown consultation. Level of information sharing and Crown consultation may vary depending upon the activity being proposed.
103. Terrestrial (road deactivation, landslide and gully rehabilitation, treatments, treatment effectiveness evaluation)					3/5	Notification /normal course Crown consultation. Level of information sharing and Crown consultation may vary depending upon the activity being proposed.
104. Site Productivity (surveys, site prep, planting, spacing)					2-3	Available on request/notification.
FIA LBIP - Information Gathering and Management Component	A/O	D	F	R		
105. Resource Inventories (terrestrial ecosystem mapping, terrain stability mapping, karst, TEM/VRI, predictive ecosystem mapping, TRIM, fish and fish habitat, recreation and visual resource, wildlife and wildlife habitat, airborne and satellite remote					2-3	Available on request/notification. Level of information sharing may vary depending on activity e.g., ground based, and timing/season of activity.

A=Administrative, O = Operational, D=District, F=Forest Investment Account, R=FIA LBIP Recipient

1. Planning- FN involvement 2. Available on Request 3. Notification 4. Expedited process 5. Normal Course Consultation: Inform & follow-up 6. Deep consultation

Activity Description	Category	Responsibility			Consultation spectrum #	PROPOSED INFORMATION SHARING/CONSULTATION ACTION
sensing data, vegetation resource inventory, woodlot inventory, community forest inventory)						
106. Resource Inventories (Archaeological Overview Assessments)					3	Notification.
107. Monitoring (water quality/quantity; terrestrial biological and physical; aquatic biological and physical; carbon sequestering)					2-3	Available on request/notification. Level of information sharing may vary depending on activity e.g., ground based, and timing/season of activity.
108. Forest Dynamics and Decision Support (site productivity estimation)					2-3	Available on request/notification.

APPENDIX 3 : Suitable Forest Stands

Site #	Forest Type	Mapsheet	General location	Polygon #	Forest Label	Site Index	Area (ha)	Foliar Samples
2008-01	Fd	82L.033	Lower Browns Creek	838/L	Fd 4301-20 sl	20	19.3	25
2008-15	Fd	82L.043	Spanish Lake	This area must be ground truthed, BEC verified			30	0 (budworm)
2008-17	Fd	82L.022	Whiteman's	4135	FdCw(SBI) 3206-20 L70#	20	37.5	0 (budworm)
TOTAL Fd							86.8	
2008-06	S	82L.023	Upper Browns Creek	466	SFd(CwPI) 3205-20 L70#	20	3.6	8
TOTAL S							3.6	
OVERALL TOTAL (ha)							90.4	

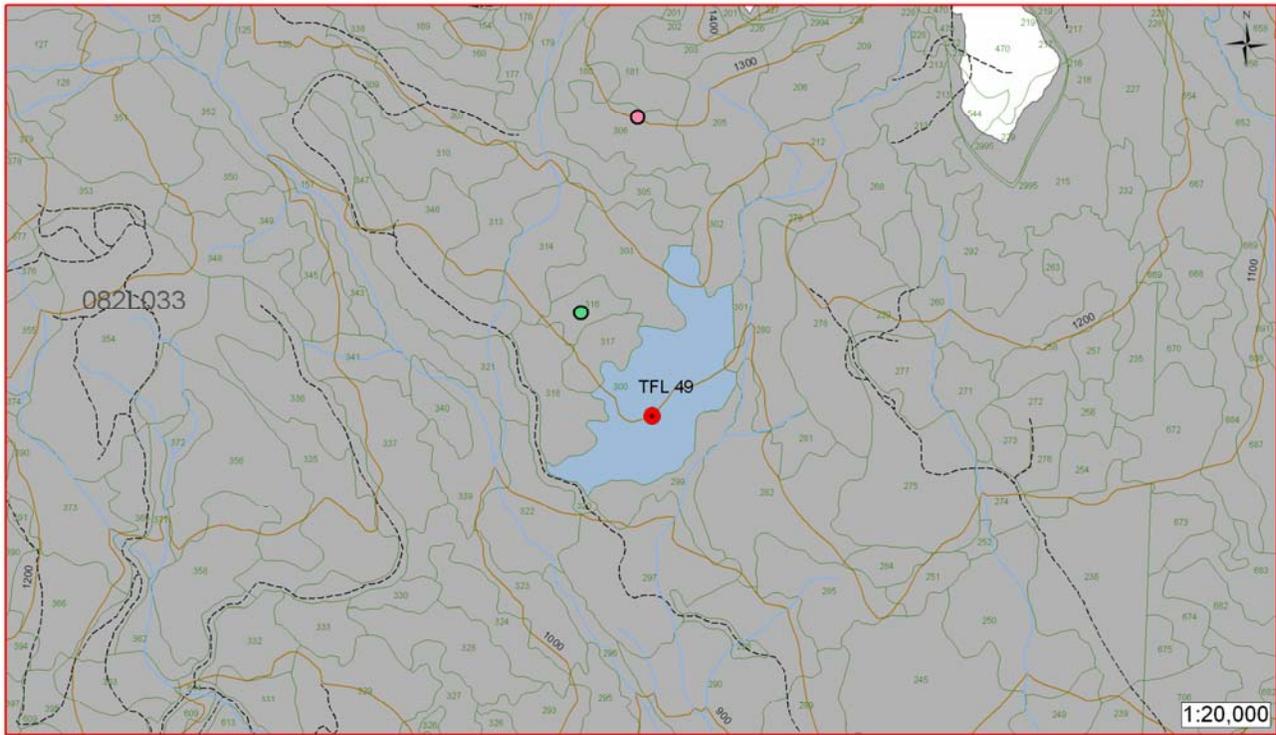
APPENDIX 3.1 : Site 1 TFL49 - 82L033 – 838 / 1228

- Polygon 838
 - **This is a good looking Fd/PI stand.** The PI is falling out as a result of MPB activity
 - There are good crowns and colour to the Fd
 - There appeared to be some root disease in the stand
 - The stand is broken into an upper and a lower area as a result of logging. The upper area is larger and more contiguous.
 - As there was no landing spot close to the stand, ground sampling was not carried out
 - Foliage sampling was completed on the Fd – 17 samples on the upper area, 8 samples on the lower area.
 - Waypoints established
 - Waypoint 1237 (50-19-524, 119-31-39)
 - Waypoint 1238 (50-19-187, 119-31-528)
 - Possible staging area from CP 888 Block 4A – Gates Creek
 - See photos (1-1 to 1-18)
- Polygon 1228
 - This stand is located between two creeks – forming a small wedge
 - The stand is largely inoperable – not treatable
 - Waypoint 1239 (50-19-173, 119-29-540)
 - See photos (1-1 to 1-2 Polygon 1228)

Polygon 838

Appendix 3 : Suitable Forest Stands

TFL 49 - Fertilization Plan 2008 82L033 Site 1

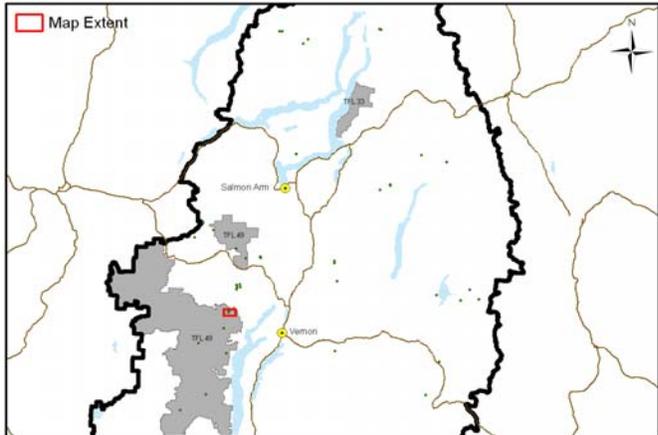


SHELL	EASTING	NORTHING	LATITUDE	LONGITUDE
	320447	5576910	50.32 N	-119.52 W
MAPSHEET	POLYGON #	FOREST COVER LABEL	AREA (HA)	
082L033	300	FdA1	331-20.1	20.7
TOTAL AREA:			20.7	

DETAILED NOTES:

This Douglas Fir/Aspen forest stand is limited only by Nitrogen

BEC Unit: ICHmk1
 Community Watershed: TBD
 Deer winter range: TBD
 Range Tenure Holder: TBD
 Watercourse: S4 east side of shell
 Access via: Siwash Creek FSR
 Fert distribution site: OK Fert, Grindrod
 Km to distribution site: TBD
 Application rate: 200 kg / ha
 Area: 20.7 ha
 Total application: 4.14 tonne



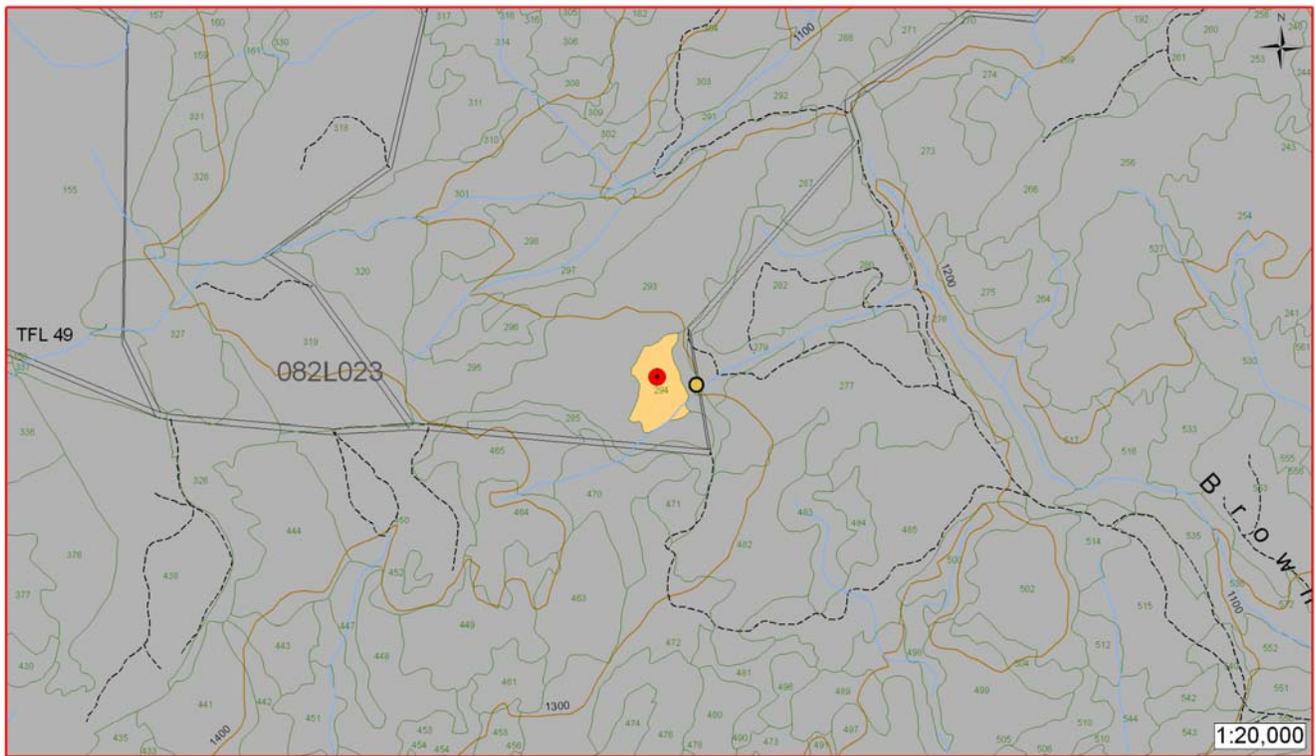
APPENDIX 3.2 : Site 6 TFL49 - 82L023 – 466 / 469

- Polygon 469 is adjacent to a creek – the type is very open with a variety of age classes. Poor fertilization opportunity with concerns about operability along the creek and not a suitable stand for treatment.
- Polygon 466 – Waypoint 1236 (50-16-288, 119-32-742) – 1340 metres elevation
- **Polygon 466** is adjacent to small patch cuts – this is a very small type (3.6 ha)
 - This is a SxFdBI stand
 - Looked at on the ground, two trees measured but ages not taken due to lack of an increment borer
 - Fdi 16.2 metres, 20 cm dbh
 - Fdi 23.5 metres, 27 cm dbh
 - Foliage samples were collected from 5 Fd and 4 Sx
 - This area would not be suitable for aerial treatment but could provide an **opportunity for a ground treatment.**
- See photos (6-1 to 6-9)
 - Creek draw is visible in upper right corner of photo 6-1

Polygon 466



TFL 49 - Fertilization Plan 2008 82L023 Site 6



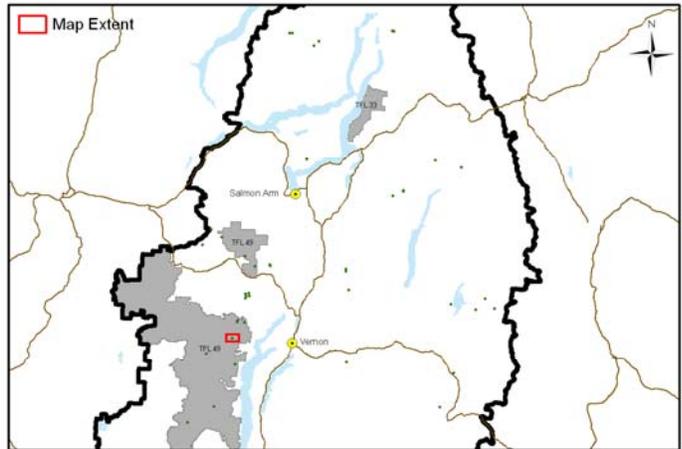
SHELL	EASTING	NORTHING	LATITUDE	LONGITUDE
	318478	5571940	50.27 N	-119.55 W
MAPSHEET	POLYGON #	FOREST COVER LABEL	AREA (HA)	
082L023	294L	SFdCwPl	325-19.7	3.6
			TOTAL AREA:	3.6

DETAILED NOTES:

This Spruce/Douglas fir forest stand is limited only by Nitrogen

BEC Unit: ICHmk1
 Community Watershed: TBD
 Deer winter range: TBD
 Range Tenure Holder: TBD
 Watercourse: S4 south corner of shell
 Access via: Browns Creek FSR
 Fert distribution site: OK Fert, Grindrod
 Km to distribution site: TBD
 Application rate: 200 kg / ha
 Area: 3.6 ha
 Total application: 0.72 tonne

All data are estimated and must be confirmed by Contractor



APPENDIX 3.3 : Site 15 TFL 49 82L053

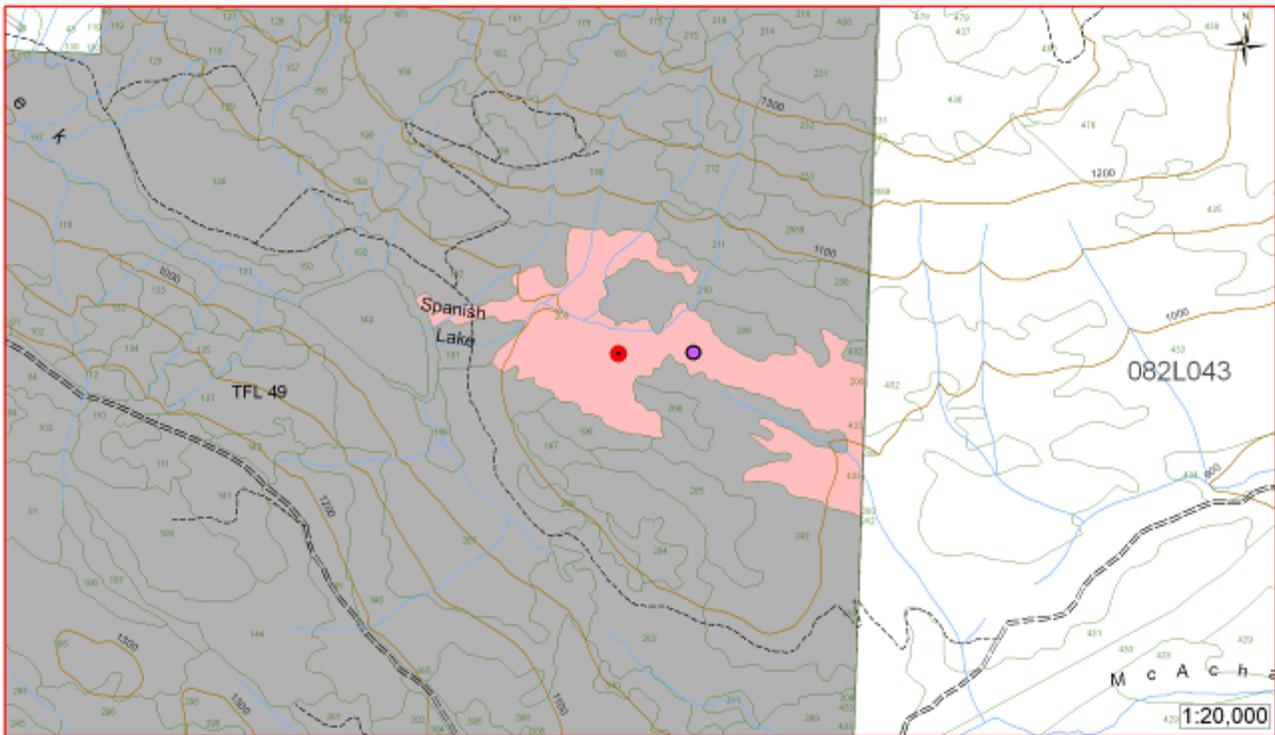
- The stand west of Spanish Lake is located on a very steep sidehill and is not operable – as a result we did not take a close look at the trees.
- The stand east of Spanish Lake had much gentler slopes however the stand was not very uniform and contained some PI. The Fd was also heavily hit by budworm, therefore no foliage sampling could be completed. This stand should be reviewed on the ground to confirm its suitability for treatment.
- Mapview identifies this site as being in the IDF, the BEC needs to be verified to confirm that this site is within a suitable subzone

See photos (16-1 to 16-7)



Appendix 3 : Suitable Forest Stands

TFL 49 - Fertilization Plan 2008 82L043 Site 15



SHELL	EASTING	NORTHING	LATITUDE	LONGITUDE
	325686	5595400	50.48 N	-110.46 W
MAPSHEET	POLYGON #	FOREST COVER LABEL	AREA (HA)	
082L043	208	FdPAILw	335-10.0	40.1
			TOTAL AREA:	40.1

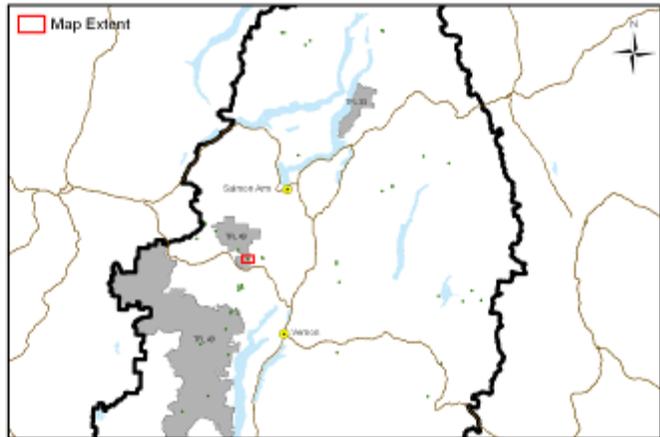
DETAILED NOTES:

This stand was not sampled due to budworm activity. The block has potential for fertilization and should be ground reviewed. BEC needs to be confirmed

This Douglas Fir Mixed forest stand is limited only by Nitrogen

BEC Unit: IDFmw1
 Community Watershed: TBD
 Deer winter range: TBD
 Range Tenure Holder: TBD
 Watercourse: S4 north side of shell
 Access via: Kelly Main FSR
 Fert distribution site: OK Fert, Grindrod
 Km to distribution site: TBD
 Application rate: 200 kg / ha
 Area: 20.7 ha
 Total application: 4.14 tonne

All data are estimated and must be confirmed by Contractor



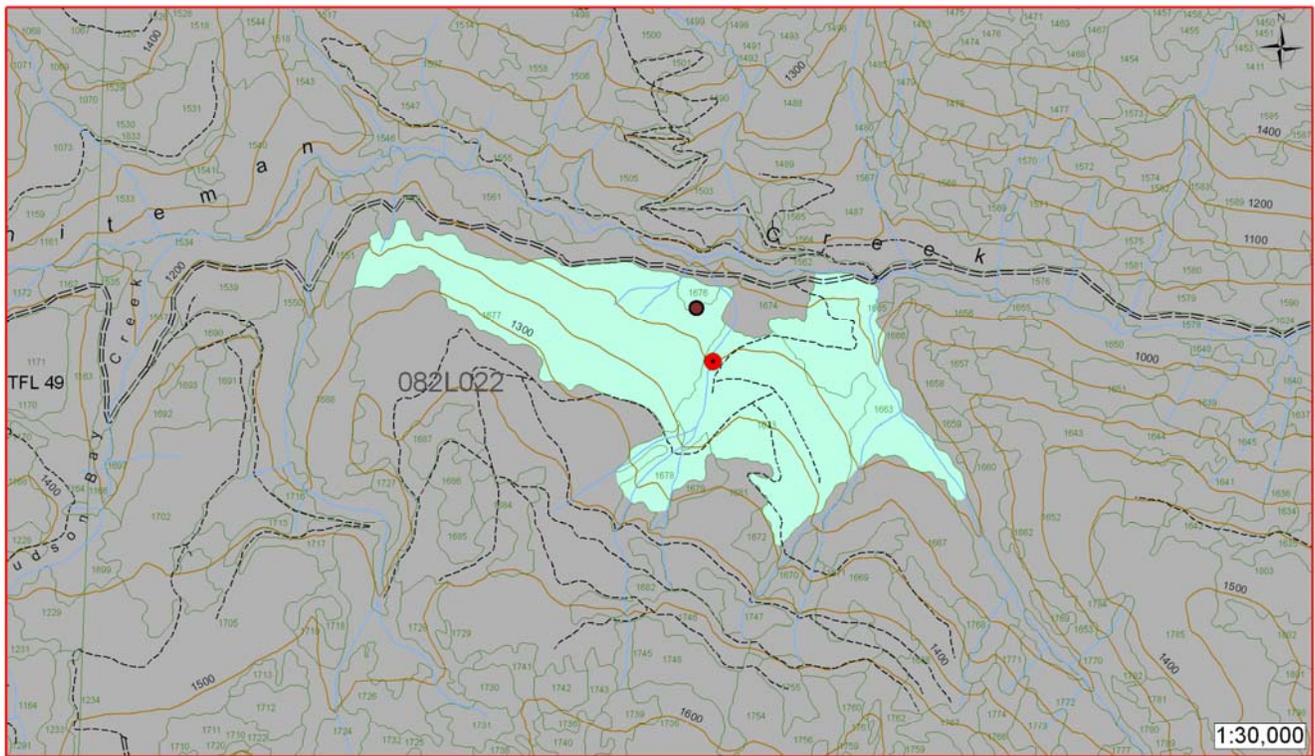
APPENDIX 3.4 : Site 17 TFL49 82L022 4135

- The Fd type located on the lower portion of this site looks good. The other polygons are inoperable due to steep slopes.
- Waypoint 1235 marks this type (50-13-371, 119-39-673)
- This site is located close to Whiteman's road – could be used for marshalling.
- There was heavy budworm activity in the tops of the Fd and therefore foliage sampling could not be carried out.
- Probably a future fertilization possibility
- See photos (17-1 to 17-13)

Polygon 4135**Polygon 4135**

Appendix 3 : Suitable Forest Stands

TFL 49 - Fertilization Plan 2008 82L022 Site 17

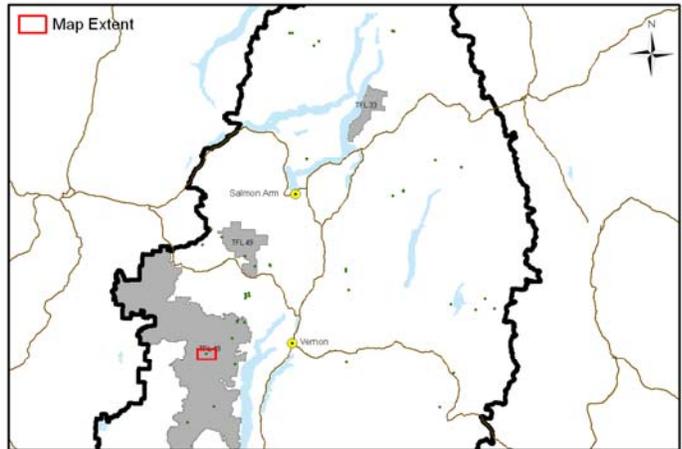


SHELL	EASTING	NORTHING	LATITUDE	LONGITUDE
	310248	5566550	50.22 N	-119.66 W
MAPSHEET	POLYGON #	FOREST COVER LABEL	AREA (HA)	
082L022	1663/L	FdCwSB	326-19.6	31.1
082L022	1673/L	FdSPIEP	324-20.0	46.7
082L022	1676/L	FdCwSB	326-20.9	2.0
082L022	1677/L	FdCwSB	327-18.6	69.9
082L022	1678/L	FdCwSB	321-20.0	9.1
082L022	1681/L	BSFdPICw	324-20.1	1.2
TOTAL AREA:				160.0

DETAILED NOTES:

Foliage sampling was not carried out on this site due to heavy budworm infestation. This unit has potential for fertilization and should be ground reviewed.

BEC Unit: ICHmk1



APPENDIX 4 : Un-suitable Forest Stands

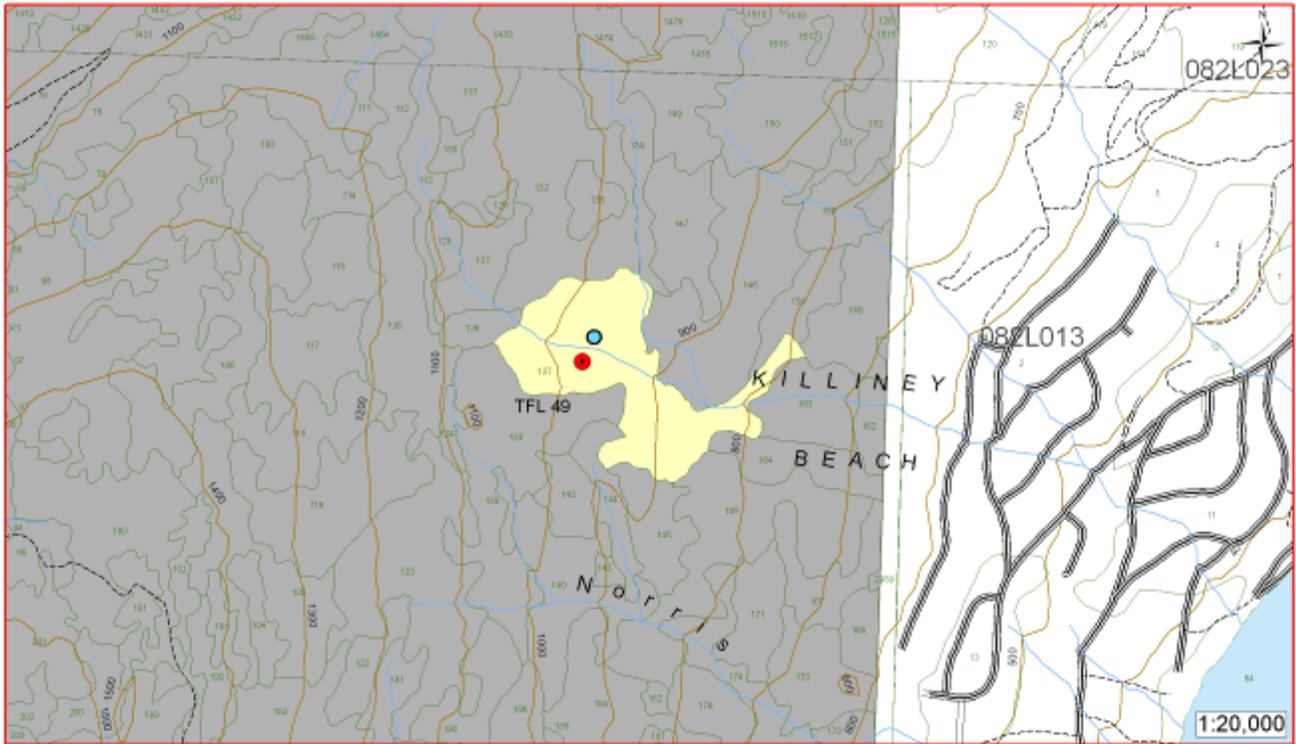
APPENDIX 4.1 : Site 9 TFL 49 82L023

- This site is mostly located on steep ground broken with rock outcrops – the area is inoperable for harvesting
- The Fd occurrence is fairly patchy and appears to be older, there is also patches of broadleaves mixed in the stand.
- The lower area of this site is very close to homes
- This area was not sampled for foliage.
- No fertilization opportunities.
- See photos (9-1 to 9-11)



Appendix 4 : Unsuitable Forest Stands

TFL 49 - Fertilization Plan 2008 82L013 Site 9

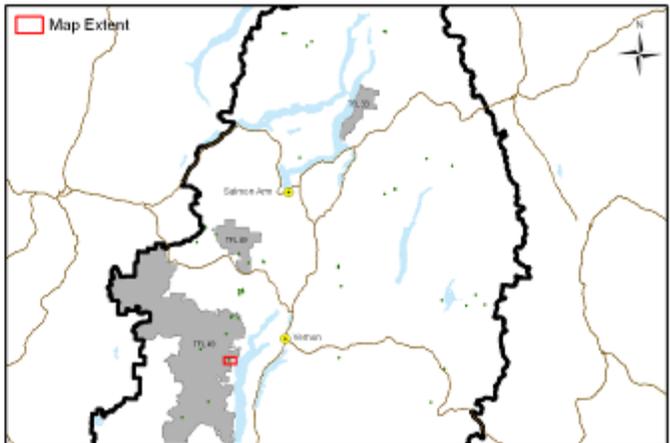


SHELL	EASTING	NORTHING	LATITUDE	LONGITUDE
	319442	5963020	50.19 N	-119.53 W
MAPSHEET	POLYGON #	FOREST COVER LABEL	AREA (HA)	
082L013	137	EpF3A1PICw	536-10.0	24.5
TOTAL AREA:				24.5

DETAILED NOTES:

This site is not suitable for fertilization:

- Steep, inoperable terrain
- Fd is scattered and appears to be of an older age class
- SE portion of the type is close to homes

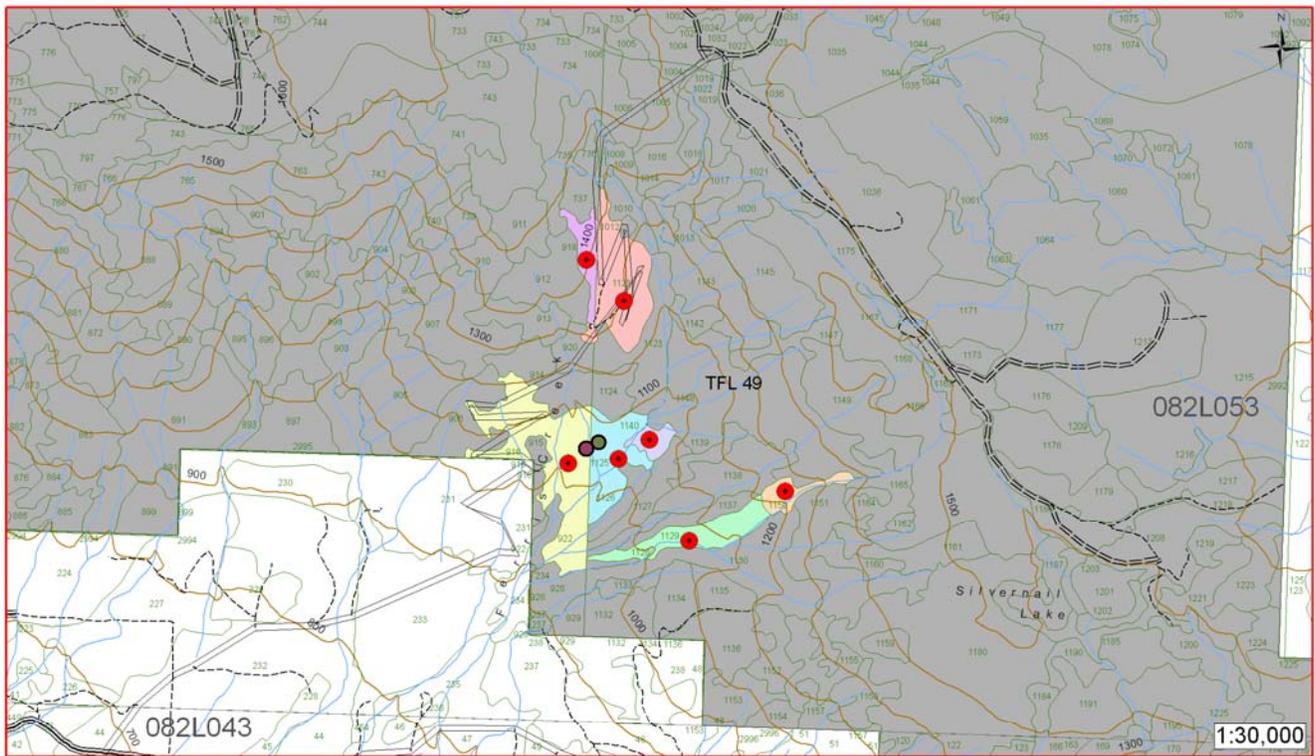


APPENDIX 4.2 : Site 16 TFL49 82L053

- The maps and air photos for this stand were reviewed and from my knowledge of this area, confirmed by Rod Watt, this area is located in the creek draw and is very steep and inoperable. This site was therefore not visited.

Appendix 4 : Unsuitable Forest Stands

Okanagan TSA - Fertilization Plan 2008 82L053 Site 10



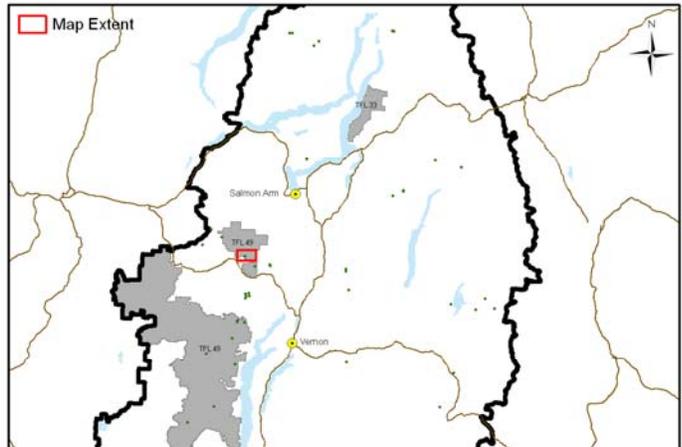
SHELL	EASTING	NORTHING	LATITUDE	LONGITUDE
	322908	5599160	50.52 N	-119.50 W
	322735	5599350	50.52 N	-119.50 W
	322650	5598410	50.51 N	-119.50 W
	322883	5598430	50.51 N	-119.50 W
	323024	5598520	50.51 N	-119.50 W
	323648	5598280	50.51 N	-119.49 W
	323208	5598050	50.51 N	-119.49 W

MAPSHEET	POLYGON #	FOREST COVER LABEL	AREA (HA)	
082L053	916	FdAIPy	433-10.0	21.4
082L053	918	FdPIAT	431-15.0	3.6
082L053	1121	FdPIAT	431-15.0	13.2
082L053	1125	FdAIPy	433-20.3	8.9
082L053	1129	FdPyEpAt	434-20.0	7.8
082L053	1140	FdEpAt	434-20.0	2.2
082L053	1150	FdPy	431-20.0	3.1
TOTAL AREA:			60.2	

DETAILED NOTES:

This site was not reviewed but it is known from personal knowledge that it is not suitable for fertilization:

- The site is in a creek draw and is very steep and inoperable.

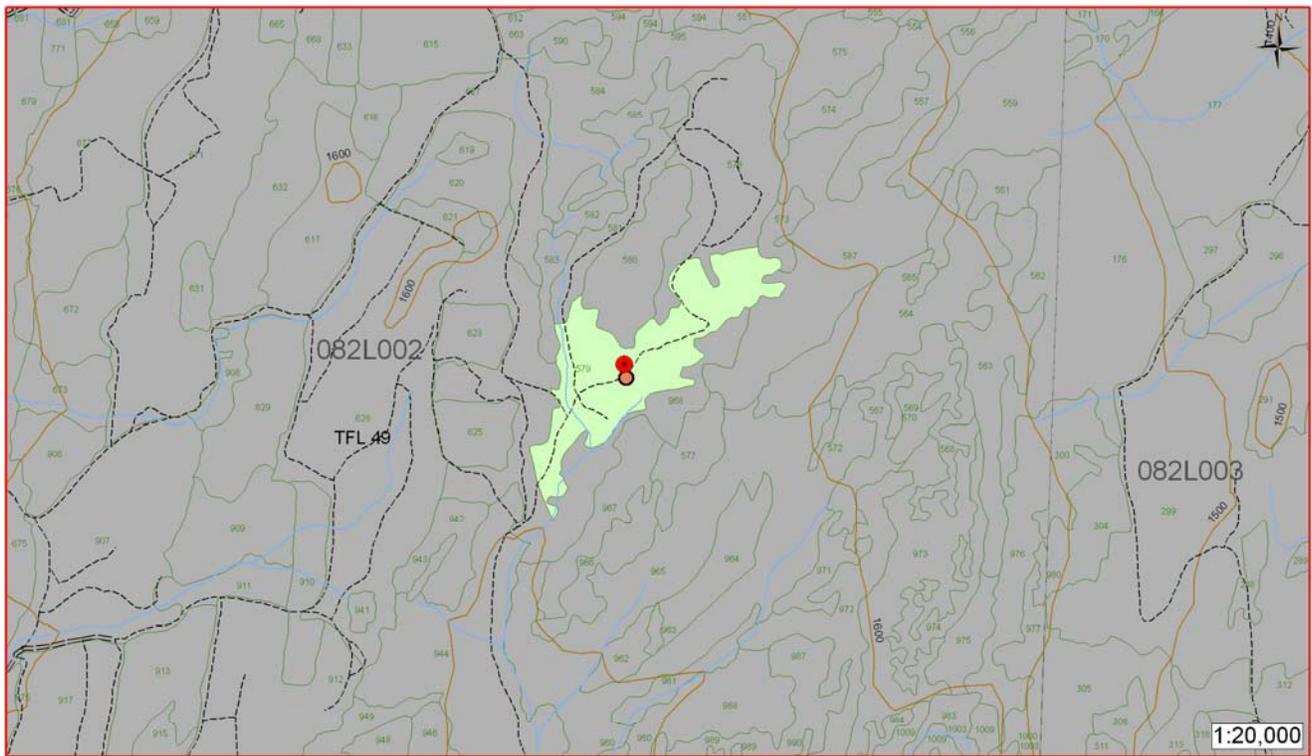


APPENDIX 4.3 : Site 18 TFL49 82L002

- Polygon 3331
 - There is more PI in this area
 - The stand also appears to be younger than Site 19
 - Not a good opportunity for fertilization
- Polygon 3283
 - There is some Sx in this stand but it is still predominantly BI
 - There is also PI in the stand
 - Not a good opportunity for fertilization
 - This area was looked at on the ground, no trees were sampled
- No foliage sampling was completed
- See photos (18-1 to 18-12)



TFL 49 - Fertilization Plan 2008 82L002 Site 18

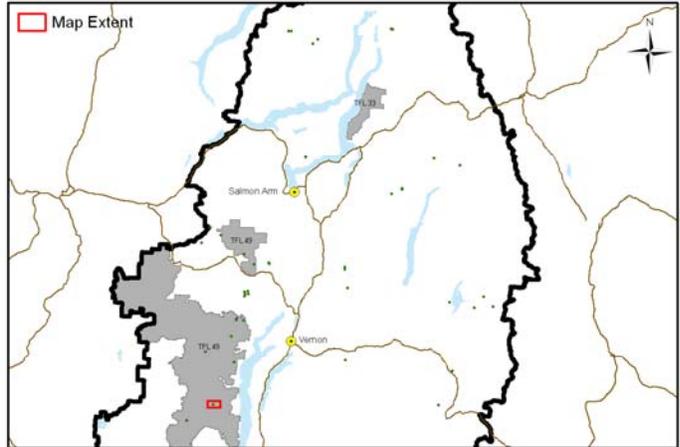


SHELL	EASTING	NORTHING	LATITUDE	LONGITUDE
	312618	5549370	50.07 N	-119.62 W
MAPSHEET	POLYGON #	FOREST COVER LABEL	AREA (HA)	
082L002	579/L	SBIAlPl	212-19.4	19.8
			TOTAL AREA:	19.8

DETAILED NOTES:

This site is not suitable for fertilization

- Species composition is predominantly BI with some PI



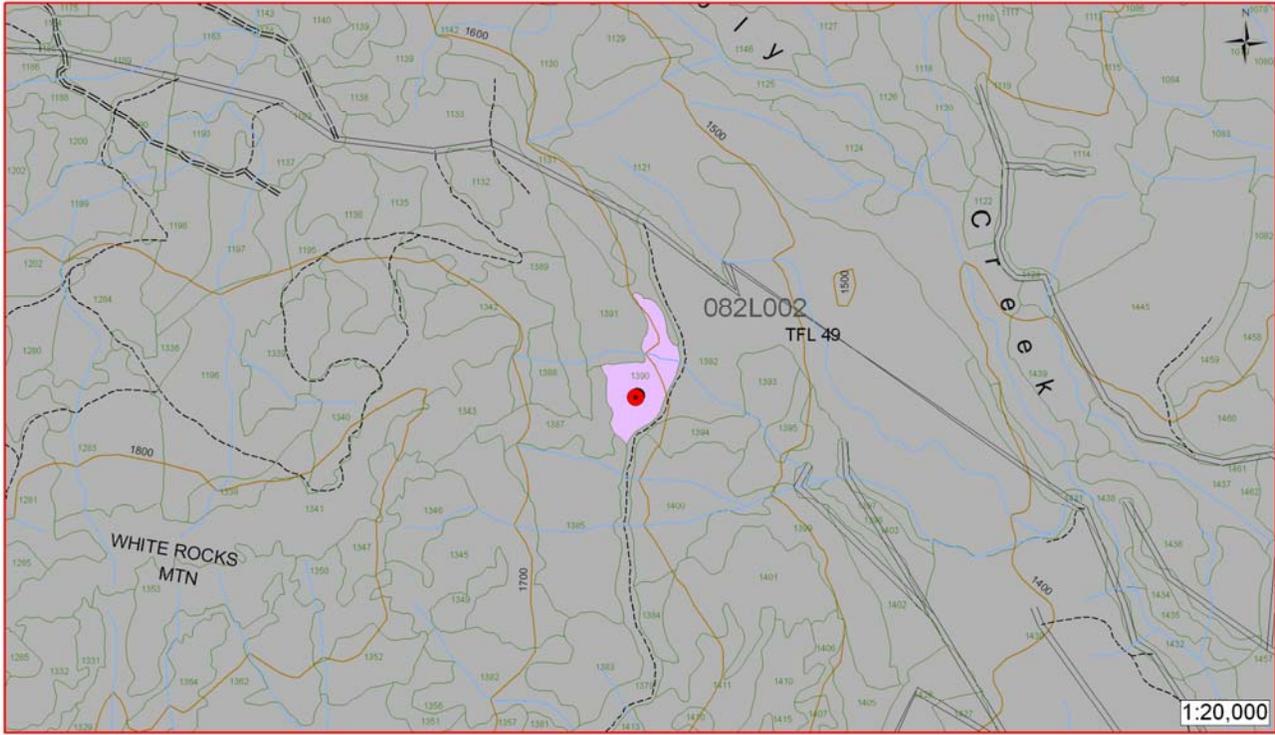
APPENDIX 4.4 : Site 19 TFL49 82L002

- This site is mostly BI with scattered Sx
- Not a candidate for fertilization
- No foliage sampling was completed
- See photos (19-1 to 19-8)



Appendix 4 : Unsuitable Forest Stands

TFL 49 - Fertilization Plan 2008 82L002 Site 19



SHELL	EASTING	NORTHING	LATITUDE	LONGITUDE
	303989	5544160	50.02 N	-119.74 W
MAPSHEET	POLYGON #	FOREST COVER LABEL	AREA (HA)	
082L002	1390/L	SBI	224-21.4	5.6
			TOTAL AREA:	5.6

DETAILED NOTES:

This site is not suitable for fertilization

- Species composition is predominantly B1

