Landspraying While Drilling (LWD) Review

Prepared by:

LWD Review Team
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Alberta Sustainable Resource Development

December 2003

Preface

On July 1, 1996, guidelines for LWD on White Area public land grasslands were approved for a two year trial period. By 1998, after a further two year trial period, Public Lands accepted LWD as a potential disposal practice on native grassland, provided appropriate conditions were adhered to.

In 2001, due to increased vegetation stress from drought conditions in the Grassland Natural Region, Alberta Sustainable Resource Development - Public Lands and Forest Division, suspended the authorization of Landspraying While Drilling (LWD) on public rangeland, native prairie throughout the province. Drought conditions appeared to aggravate potential impacts of LWD on native prairie. As well, a number of operational concerns have been raised relating to LWD.

A review has been initiated because of industries request to lift the moratorium and desire to continue using LWD on native prairie on public rangeland. This report is a collection of information and data that has been assembled by the LWD Review Team to assist in the completion of the review.

A facilitated process held in Calgary on November 27, 2003, provided a forum for staff to jointly review the available data and inputs on LWD, to collectively list the key issues emerging from the review and finally to develop recommendations to address the key issues. The results of the review, set the stage for the next phase, to consult with other government agencies and ultimately with industry.

LWD Review Team and Report

This document is the consensus report of the LWD Review Team of Alberta Sustainable Resource Development. Team members include:

Land Use Branch	**Rangeland Management Branch**	**Facilitators**
John Begg, Edmonton	Barry Adams, Lethbridge	Dom Ruggieri, Calgary
Kevin Ball, Edmonton	Bruce Cairns, Medicine Hat	Suzanne Hawkes-Gill
Barry Cole, Red Deer		Calgary
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Executive Summary

On July 1, 1996, guidelines for LWD on White Area public land grasslands were approved for a two-year trial period, as a method to reduce the area of native prairie disturbed during sump construction. The approval of the guidelines had been pursuant to a field study undertaken during 1994/1995 to monitor effects of LWD on native prairie using conventional equipment and methods. The research project concluded that little adverse effect was observed save for short-term coating of vegetation by land spray materials until rainfall washed materials off or until it was redistributed by wind.

By 1998, after a further two-year trial period, Public Lands accepted LWD as a potential disposal practice on native grassland, provided appropriate conditions were adhered to. In 2001, due to increased vegetation stress from drought conditions in the Grassland Natural Region, Alberta Sustainable Resource Development - Public Lands and Forest Division, suspended the authorization of Landspraying While Drilling (LWD) on public rangeland, native prairie throughout the province. A review has been initiated because of industry's request to lift the moratorium and desire to continue using LWD on native prairie on public rangeland.

The review of LWD is to occur in two parts. Phase 1 of this review is to provide direction with regards to lifting the moratorium on Landspraying While Drilling on native range, as well as a recommendation for any mitigating conditions that may be required. Phase 2 of this review will address the current policy entitled "Policy for Landspraying While Drilling on Public Land in the White Area" dated February 26, 1999. The possible outcomes of this review will be a revised policy dealing with LWD or the policy being rescinded. Stakeholder input will be an integral part of this process.

Phase 1 has been undertaken internally by ASRD by a review team from the Land Use Operations Branch and Rangeland Management Branch of Public Land and Forests Division. The review has included the review of LWD case files and field inspection records, a field audit of LWD sites at SFB Suffield, a review of LWD alternatives, staff feedback and feedback from other land managers in the region like the Special Areas Board, the Eastern Irrigation District and CFB Suffield. Issues and key recommendations were then developed from the available data through a facilitated meeting of the LWD team.

The review of the LWD file paper trail and of field inspection reports from the Medicine Hat office highlighted a number of major issues including LWD projects being applied outside of the approved area, no final field report, field plans of poor quality, heavy loading rates of LWD materials and siting problems.

The survey of LWD sites within CFB Suffield highlighted concerns with the poor distribution of LWD residual solids; associated smothering impacts to grassland vegetation where there were skins and mudpacks of LWD materials; mechanical impacts like rutting;

and siting problems such as application on sand dunes, watercourses, wetlands and steep slopes.

Four alternatives to LWD on native prairie were outlined including conventional sumps, remote sumps, transport to cultivated land or tame grassland, or to a disposal facility.

Most of the issues highlighted in the file review and field survey were also mentioned in staff comments, including adherence to the approved spray area, problems with spread distribution, site selection problems and problems with record keeping.

In other jurisdictions, experience with LWD was mixed. Two of three land management agencies interviewed expressed concerns about LWD. The Eastern Irrigation and CFB Suffield allow LWD but with special conditions, while the Special Areas Board does not allow LWD on native range.

The results of this review need to be reconciled with those of the original industry study. The Pedocan study was a field demonstration of a new practice on a relatively limited number of sites with careful control over site selection and landspraying operations, and also with climatic conditions favorable for washing LWD solids from the vegetation. In this review of LWD practice, a greater appreciation is gained of the shortcomings of LWD in an operational setting with a full range of variability in climatic conditions including drought. A significant number of problems and issues have been identified through the review of hundreds of project files and field reports, from a field survey of project sites, from the experience with LWD in other jurisdictions, as well as the experience of departmental staff.

The file review and field observations revealed that on a high percentage of sites LWD is not being applied according to the guidelines. This is having a negative impact on native range. The current LWD policy needs to be revised, with stakeholder input, to address these operational concerns.

From the review it is apparent that drilling waste applied under the LWD persists on native range longer than previously thought and may have negative impacts on native prairie even when applied according to the current guidelines. Further research will need to take place to determine the exact nature of these impacts.

As a result of this review, the committee feels that issues and operational deficiencies must be addressed before LWD can be resumed on native prairie. Recommendations are provided to address the key issues identified in the review to address administrative, operational and environmental issues. A number of research priorities are also highlighted.

Landspraying While Drilling (LWD) Review
Alberta Sustainable Resource Development
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1.0 Introduction

1.1 Background

The practice of landspraying while drilling was developed as a drilling waste disposal system in the early 1990's. The method involved use of a gel-chem mud system, with a sumpless drilling process. Tank stored drilling fluids would be sprayed onto cultivated land using vacuum trucks. In the mid 1990's the process was adapted to disposal of freshwater gel drilling waste on native rangeland. The adaptation was conceived as a method to reduce the area of native prairie disturbed during sump construction. A field study was undertaken during 1994/1995 to monitor effects of LWD on native prairie using conventional equipment and methods. Three field test sites were established at Taber, Alderson and Medicine Hat. High (40 cubic m) and low (20 cubic m) spread rates were compared for three application dates in fall, spring and summer. The impact assessment relied on relatively coarse measures of rangeland function including plant cover, seed head phenology, plant species composition and forage quality. Soil quality monitoring included testing for key chemical parameters and measurement of water infiltration rates. The study did not include any analysis of direct or indirect impacts on wildlife or livestock[1]. The research project concluded that little adverse effect was observed save for short-term coating of vegetation by land spray materials until rainfall washed materials off or until it was redistributed by wind[2].

Subsequent to this field trial, LWD was used in shallow gas drilling programs in SE Alberta up until a moratorium was applied on the method during the recent drought. Sprayed materials persisted on the soil and vegetation surface during the drought period which became a concern to resource managers and livestock producers. The moratorium phase provides an opportunity to review the relative success and efficacy of the LWD process and to make recommendations regarding the use of the system in the future[3].

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[1] . (Comment): Based on the February 5th. 1999 Policy for LWD under the Research Section there is the opportunity to request additional research relative to wildlife. We perhaps need to pursue this with industry as part of the LWD policy and include livestock.

[2] (Comment): Redistribution by wind suggests to me a very light application. Given the recent drought conditions has redistribution by wind ever been part of any monitoring?

[3] (Comment): Based on our recent conference call discussion we need to indicate the intent behind this review being twofold. We discussed the lifting of the moratorium as well as the policy review and update.

1.2 LWD Review

1.2.1 Scope and objective:

Phase 1 of this review is to provide direction with regards to lifting the moratorium on Landspraying While Drilling on native range in the White Area of Alberta[4], as well as a recommendation for any mitigating conditions that may be required.

Phase 2 of this review will address the current policy entitled "Policy for Landspraying While Drilling on Public Land in the White Area" dated February 26, 1999. The possible out comes of this review will be a revised policy dealing with LWD or the policy being rescinded. Stakeholder input will be an integral part of this process.

Phase 1 of the review process has been undertaken internally by ASRD since most of the original staff involved in the original pilot are still present in the affected region. A working group met several times to consider the available sources of information on which to base the review and the following review components were agreed upon:

- Review of LWD case file and field inspection records from the Medicine Hat office and AEUB LWD audit results
- Randomized selection and field audit of LWD sites at CFB Suffield
- Review of alternatives to LWD
- Seek feedback from ASRD field staff observations, issues and concerns about the LWD methodology
- Seek feedback from resource managers in the affected area as to their current views, experience, operating conditions for LWD (CFB Suffield, Eastern Irrigation District, Special Areas Board, Fish and Wildlife, Water Management, AFRD)

The results are presented in each section with a synthesis discussion in section 3.0, followed by a summary and recommendations section.

Once the available data and inputs from staff and other land managers was compiled, a facilitated meeting was held in Calgary on November 27, 2003, to provide a forum for the LWD Review Team to identify key issues and then formulate recommendations to address key issues. Issues and Recommendations are identified in sections 4.0 and 5.0 of the review document respectively.

1.2.2 Linkage to SRD Business Plan

Public lands support a variety of industrial and commercial activities as part of an integrated and multiple-use approach to land management. This approach provides a

[4] Landspraying While Drilling occurs only on a limited basis in the Green Area and is referred to as DOLOC (Disposal on License of Occupation). This would include landspraying on working areas that have been cleared of forest cover.

number of economic, social and environmental benefits to Albertans, as reflected in the department's Mission Statement:

> *To ensure the sustained contribution of benefits to Albertans from Alberta's public land and natural resources*

Other key sections of the department's 2003-2006 Business Plan that support the review of land spraying while drilling on native public rangelands include:

GOAL 4 Enhance the economic, environmental and social contributions of Alberta's rangelands to Albertans.

Strategic Approach

- *Provide a clear, balanced approach to rangeland management through a rangeland management policy, legislative and regulatory framework that maximizes the benefits Albertans accrue from public rangelands.*
- *Ensure that Alberta's livestock industry has access to long-term, secure public rangeland grazing.*
- *Support sustainable range management practices and decisions through coordinated inventories, knowledge transfer and applied research programs.*
- *Encourage good stewardship practices by monitoring utilization of public rangelands.*
- *Manage public rangelands in a manner that supports the co-existence of multiple uses and resource values.*

GOAL 5 Optimize the long-term benefits (environmental, social and economic) that Albertans receive through effective, efficient disposition management.

Strategic Approach

- *Provide an integrated, balanced approach to land use through a land management policy, legislative and regulatory framework that maximizes the long-term benefits Albertans accrue from public lands.*
- *Encourage sustainable land use practices through integrated land use planning by government and industry.*
- *Ensure dispositions for the use of public lands are issued in a timely, effective manner with the appropriate and relevant conditions.*

There are a number of significant opportunities and challenges that SRD faces to improve Alberta's sustainable resource management system. The department's 2004-2007 Business Plan identifies two such challenges that support the need to review the current practice of LWD on public lands. Developing a clear framework to address land spraying while drilling on public native rangelands will make an important contribution to meeting these challenges:

Industrial Footprint and Access Management recognizes that resource development will continue to be an important part of the Alberta economy and that sectors like oil and gas require access to public lands and natural resources to support their growth.

Climate Variability recognizes that the department faces challenges arising from natural events such as climate variability causing drought, fires, and pest outbreaks. These natural challenges highlight the need to have regulatory practices that are responsive and adaptive to changing environmental conditions.

2.0 LWD Review Components

2.1 Review of LWD case file and field inspection records

File records and field inspection reports of LWD project sites maintained in the Medicine Hat office (Alberta Sustainable Resource Development) provided a substantial source of information for review purposes. A total of 323 project files were located of which 309 were reviewed. Within these 309 files, 167 had associated field assessments. A contractor reviewed individual files and field inspection reports during August 2003 for compliance with the enforceable conditions of the industrial disposition/temporary field authority[5]. The results and observations for each file reviewed were summarized in an Excel spreadsheet. Problems and issues were summarized into broad categories and pass or fail status for each file record and field inspection report was noted in the spreadsheet.

Highlights

- Of the 309 files reviewed, 88 LWD projects (28%) were judged as having significant problems or deficiencies.
- Of the 167 field inspections reviewed, 49 of 167 (29%) were judged to have significant problems or deficiencies.
- There were 14 incidents where LWD has been carried out on public land for which there is no record on GLIMPS or LSAS. Reasons include a) LWD spread went over a section boundary and the TFA/LWD approval was never corrected b) the LWD was done without approval and hence Public Lands did not issue an approval that would have flagged it on the land standing.

Table 1 Number of files, number of files assessed, number of LWD project failures and percentage failures of total assessed files in the Medicine Hat Area (1997 – 2001).

	TOTAL FILES	NO. ASSESSED	LWD PROJECT FAILED	PERCENT FAILED OF TOTAL ASSESSED PROJECT SITES
File Audits	323	309	88	28.4
Field Audits	323	167	49	29.4

[5] Comment: Conditions are enforceable. Need to further breakdown the status for operational failures vs. environmental failure - when applications were Public Lands policy or G50 compliant.

File Audits – Reasons for LWD Project Failure (see Table 2 and Figure 1)

- A total of 88 of 309 (28.4%) sites were judged to have failed to meet conditions of the disposition or temporary field authority[6]. Of these 88 sites:
  - At 46 sites, the final field report shows that the LWD applications were made outside of the approved area.
  - A total of 16 sites did not have a final field report on file. The success of an application cannot be made without this report.
  - A total of 13 final field reports were of such poor quality that it was not possible to evaluate LWD location relative to the approved area
  - A total of 13 files showed LWD locations that would be judged as contraventions of TFA conditions due to proximity to dugouts, spraying through watercourses, where rutting had been observed or with applications on a fragile sand dune location.

- A total of 14 LWD sites were not part of the file review paper trail (not part of the 88 sites listed above). These sites were not recorded in GLIMPS or LSAS. These files had LWD approvals but files were cancelled and no longer in the Medicine Hat office, had no more LWD information in them, or were missing all together.
  - Two sites were examples of LWD on freehold that was transferred to public land – i.e. LWD projects without approvals.
  - At two locations, multiple spreads occurred on the same site.

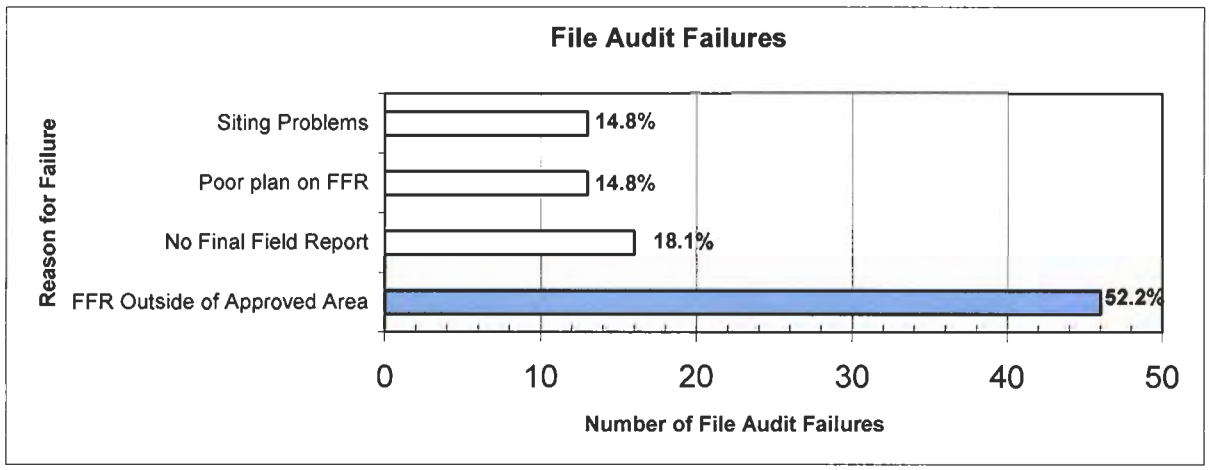
Table 2 File review - reasons for LWD project failure by number of projects, % of failures by reason and % failures of total files reviewed in the Medicine Hat area (1997 to 2001), n=323 files reviewed.

Reason for Failure	Number	% of Failures	% or Total Files
FFR Outside of Approved Area	46	52.2	14.8
No Final Field Report	16	18.1	5.2
Poor plan on FFR	13	14.8	4.2
Siting problems	13	14.8	4.2
Total	**88**	**100**	**28.4**

FFR=Final Field Report

[6] Comment: All failures listed below would be considered unauthorized use or contraventions of the Public Lands Act, Terms and Conditions under either sections 48(1) or 49(1).

Figure 1 File review - reasons for LWD project failure by number of projects, percent failures by reason and failures by percentage of total project sites evaluated in the Medicine Hat area (1997 to 2001), n=323 files reviewed.



Field Audits – Reasons for LWD Project Failure (see Table 3 and Figure 2)

- A total of 49 of 167 (29.4%), sites were judged to have failed to meet conditions of the disposition or temporary field authority[7]. Of these 49 sites:

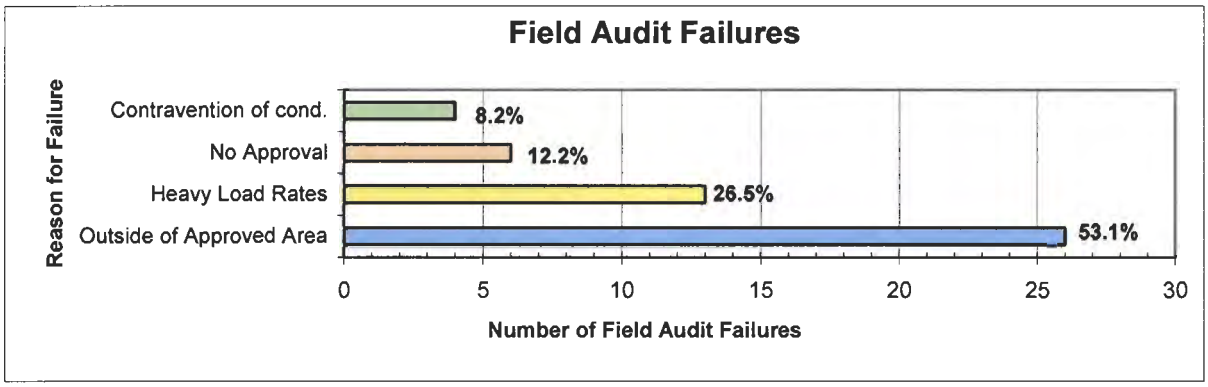
  - At 26 locations, LWD occurred outside of the approved project area.
  - At 13 locations there was evidence of heavy applications of solids including mud packs, tailing piles, areas where liquids pooled and heavier solid deposition where vehicle ground speeds decreased causing heavier application rates.
  - There were no approvals for six locations
  - At four sites there were miscellaneous issues including spraying within 100 m of a dugout, spraying through a watercourse, too close to coulees, multiple spreads and spreading on high value habitat like sagebrush cover.

Table 3 Field inspection review - reasons for LWD project failure by number of projects, percent of failures by type and failures as a percentage of total project sites evaluated in the Medicine Hat area (1997 to 2001).

Reason for Failure	Number	% of Failed	% of Total
Outside of Approved Area	26	53.1	15.6
Heavy Load Rates	13	26.5	7.8
No Approval	6	12.2	3.6
Contravention of conditions	4	8.2	2.4
Total	**49**	**100**	**29.4**

[7] Comment: All failures listed would be considered contraventions of the Public Lands Act, Terms and Conditions under either sections 48(1) or 49(1).

Figure 2 Field inspection review - reasons for LWD project failure by number of projects and percent of failures by type of project sites evaluated in the Medicine Hat area (1997 to 2001).



Summary of File and Field Inspection Review

The review of file and field inspection reports from the Medicine Hat office revealed a significant number of issues and deficiencies with LWD practices in the district, at approximately the same frequency of occurrence, at 28% for the file report and 29% for the field inspection reports. Note that all failures listed below would be considered unauthorized use or contraventions of the Public Lands Act, Terms and Conditions under either sections 48(1) or 49(1). These are listed below as a combined list relative to the frequency (percent of total file audits or field reports) with which the issue, deficiency or contravention was observed from the total number of files reviewed:

1. LWD fell outside of the approved area **(14.8%/15.6%)**.
2. Heavy loading rates of LWD materials **(7.8% of field reports).**
3. No final field report **(5.2% file review)**
4. Poor plan **(4.2% file review)**
5. No approval **(3.6% field audits)**
6. Siting problems **(4.2% file review/ 2.4 % field reports)**

A total of 14 sites were identified that were not part of the file review paper trail and were not recorded in GLIMPS or LSAS.

2.2 Randomized Selection and Field Survey of LWD Sites at CFB Suffield

A key finding of the original LWD study carried out by Pedocan Land Evaluation Ltd. (1996) was that sprayed solids did not persist longer than a few weeks. This finding is the basis for the conclusion that no adverse effects result from LWD practice. Key findings from the research report are quoted below:

> *Application of tested drilling waste types by the LWD method, at the 20 and 40 m3/ha rates, showed no adverse effects that persisted longer than a few weeks. (Last sentence, Executive Summary, page x)*
>
> *One week after spreading some evidence of the drilling waste remained as a slight, grayish dust covering. (Page vii, Executive Summary, para 3; after 79.1 and 59.5 mm of precipitation at the Taber and Alderson test sites respectively)*
>
> *It is apparent that the visual evidence of the drilling waste application persists for generally a short period of time, until it is redistributed by wind or precipitation. (Page vii, Executive Summary, para 3)*

One of the major issues raised by Public Lands staff during the intervening years since LWD was adopted as an approved practice was that LWD materials were found to persist for much longer time periods than the original research suggested and that there was a general concern about the evenness of spread distribution on the landscape over the treated area. A field survey was proposed to examine LWD sites of variable age for persistent LWD materials and for any correlated adverse effects or operational issues.

CFB Suffield was favored for the survey owing to the existence of a spatial database of LWD locations. The LWD methodology has been employed on the base since the late 1990s. Though ASRD does not act as land manager within CFB Suffield, the department has a long-term relationship with the base through the Suffield Grazing Advisory Committee (SGAC), which was established in 1977. Base environmental staff have consulted with staff of ASRD in recent years on LWD practices and have been engaged in the ongoing dialogue on issues.

Since 2000, base environmental staff have required detailed spread location information along with the normal information about loading rates and description of spread materials. In the past year, this information has been entered into a spatial database. This data set provided a useful information source for locating spread sites for follow up field evaluations.

Survey Objectives:

A field survey was undertaken of LWD sites within CFB Suffield to:

1. Confirm the presence or absence of persistent LWD materials,
2. Examine areas of persistent LWD materials for any obvious secondary impacts on range vegetation,
3. To examine LWD sites for adverse mechanical impacts,
4. and, to evaluate LWD sites for contraventions of terms and conditions on site selection.

Field Survey Methods

Records for a total of 504 spread sites from the period 2000 to 2003 were available for the field audit. During this time period, LWD applications occurred along prairie trails. A randomized sample of sixty field sites was obtained for field inspections. Once the LWD spray point was located, the spray could be followed in conjunction with or pipeline. Given the size and complexity of travel in the military training area, a Bell 206 Long-Ranger aircraft was used to transport field personnel to survey sites. Spread sites were located by navigating to the GPS coordinates that defined the beginning of the spread area. The spread pattern was then located on the ground using GPS equipped iPAQ handheld computers with the spread areas identified on Arcpad digital maps.

After a group training exercise to ensure consistency, a team of four field personnel, located and surveyed 42 of 60spread sites on August 28 and 29, 2003. The other 18 random sample sites could not be accessed due timing conflicts with the first priority military training schedule and having to observe no fly zones.

The following parameters were evaluated at each spread site:

- Presence or absence of LWD spread materials.
- Distribution of persistent spread materials, including mudpacks and thickness of persistent spray material
- Where a clear correlation between persistent solids could be made, evidence of residual vegetation impacts was noted in the form of changes in vegetation color, species, density and biomass; description of disturbance plant species
- Evidence of mechanical impacts including rutting, tracking and litter compression
- Site selection problems including proximity or crossing of watercourses, application on excess slopes or multiple treatments of the same site.
- Problem sites were photographed

Survey Results

- Of the 42 sites sampled, 20 were from 2001, 15 from 2002 and 7 from 2003. The smaller sample of sites from 2003 was due from the relatively smaller limited number of sites available for evaluation.
- Overall loading rates for the entire sample of 504 sites were reported in the range of 5 to 20 m^3 (this falls within the EUB G50 guideline for winter applications of 20 m^3)
- The method of locating old LWD sites for evaluation was highly effective since at most sites spread materials could be observed where slope changes would have

affected ground speed of the spraying trucks and hence application rate of spread materials, resulting in residual skins of silver gray material.

- Table 4 and figure 3 summarize the total number and percentage of sites that showed evidence of LWD materials, vegetation and mechanical impacts, and, locations with obvious siting problems.
- In the overall ranking of observed parameters (Table 4, Figure 4) 86% of sites showed evidence of residual LWD materials with many of these sites having problems with the distribution of spread materials, 71% of sites exhibited residual effects on vegetation, 37% showed mechanical impacts and 35% showed problems with site selection.

Spread Distribution

- In terms of spread distribution, residual materials were visible in the form of mudpacks or as skins of variable thickness on 86% of sites. The LWD material was normally a blue to silver-gray material. Residual LWD material was observed on the majority of the surveyed sites in the following locations:
  - o at the beginning or resumption of spreading operations for 5 to 30 m of lineal distance,
  - o in sections of the spray right-of-way where and upslope grade was encountered by the spray truck, presumably where spray truck application speeds would have decreased and application rates increased,
  - o where ground roughness would have forced the slowing of ground speed during by the spray truck,
- Spread material residues were observed in variable thickness (Table 5 & 6, Figure 5): 40 percent of sites were 1 to 5 mm, 20 percent were 5 to 30., 17 percent were 1 mm or less and 8.6% were between 30 to 75 mm in thickness.

- While the years 2001 and 2002 showed a full range of spread thickness, the seven sites from 2003 showed LWD residues in the bottom two ranges (3 sites at <1 mm, 3 sites with residues at 1 to 5 mm, 1 site with no evidence of LWD materials). On these sites, LWD cutans or skins were observed on upgrades, dune tops or other rough terrain.

- Note that where vegetation impacts have been attributed to LWD, it has been for the top three LWD thickness levels where vegetation masking or smothering was observed.

Table 4 Number and percent of survey sites by type of LWD variable evaluated at CFB Suffield, August 28 – 29, 2003.

Number of Sites by LWD Variables

	Evidence of LWD Materials	Veg. Impact	Mech. Impact	Site Selection Problems
Visible Evidence, Impacts or Problems	36	30	13	15
No Apparent Evidence, Impacts or Problems	6	12	29	27
Total Sites	42	42	42	42

Percentage of Sites by Types of LWD Impacts

	Evidence of LWD Materials	Veg. Impact	Mech. Impact	Site Selection Problems
Visible Evidence, Impacts or Problems	85.7	70.7	37.1	35.0
No Apparent Evidence, Impacts or Problems	14.3	29.3	62.9	65.0
Total Sites	100	100	100	100

Figure 3 Total number and percent of sites with visible evidence, impacts or problems with LDW at CFB Suffield, August 28-29, 2003.

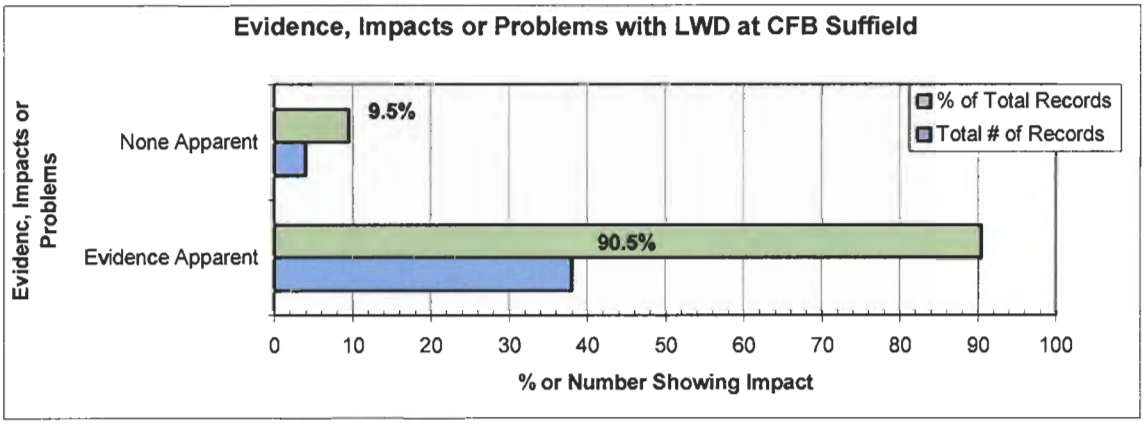


Figure 4 Number of survey sites with visible evidence, impacts or problems with LDW at CFB Suffield, August 28 – 29, 2003.

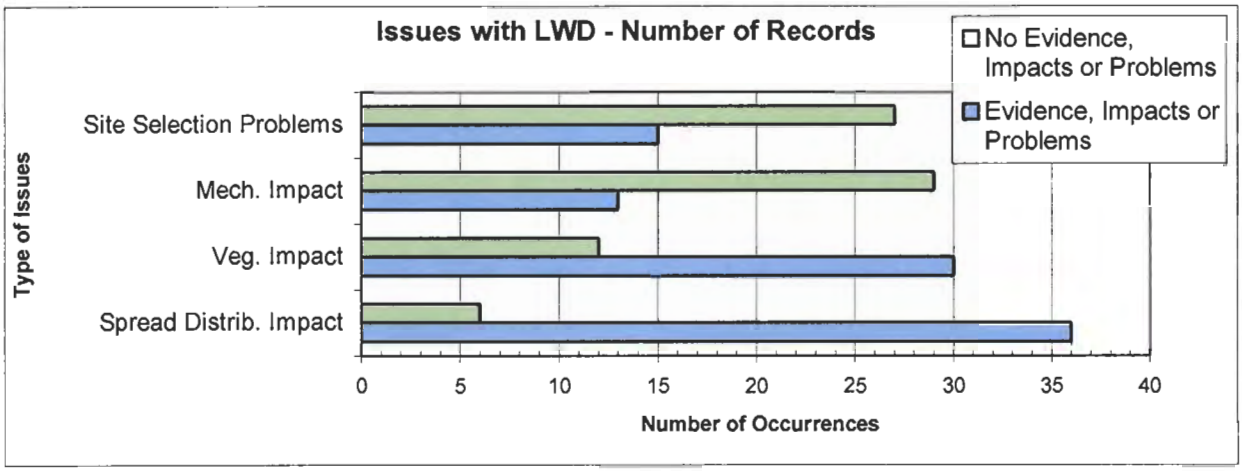


Table 5 Spread thickness of LWD materials at CFB Suffield, August 29-29, 2003.

Spread Distribution of LWD Deposits						
	No Apparent Residue	<1	1 to 5	5 to 30	30 to 75	Total
# of Occurrences	5	6	14	7	3	35
% of Total	14.3	17.1	40.0	20.0	8.6	100.0

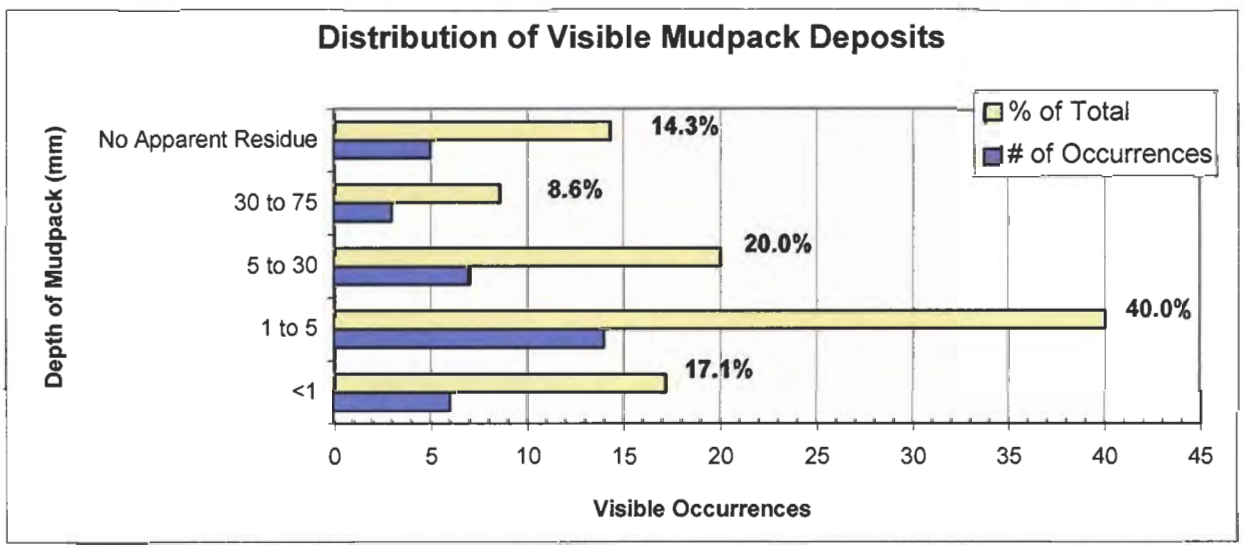


Figure 5 Spread material thickness at CFB Suffield, August 28-29, 2003.

Spread Thickness of LWD Deposits	
Depth of Deposit (mm)	# of Occurrences
< 1 or thin skin	6
1	2
1 to 2	3

2	2
1 to 3	2
2 to 3	1
2 to 5	1
3 to 5	2
5	1
5 to 10	2
up to 10	1
10 or thicker	1
5 to 20	1
20 to 30 in places	1
5 to 25	1
up to 40	1
up to 70	1
5 to 75	1

Table 6 Definition of spread material thickness by occurrence at CFB Suffield, August 28-29, 2003.

Vegetation Impacts

- Visible impacts to vegetation were correlated with areas where spread materials persisted (Table 7 and Figure 8) and were observed on 71% of sites.
- Only the vegetation impacts that were clearly associated with spray applications are reported here to minimize the potential confounded impacts associated with the trail system itself
- Visible evidence of vegetation change was as follows:
    - An increase in disturbance species was apparent on 25% of sites
    - Apparent reductions in biomass production were observed in 24% of sites
    - Both plant density and color appeared to be altered on 16% of sites
- The most common impact was the increase in disturbance species like fringed sage, pepper-grass, various goosefoot species, plantain and flixweed.
- Increases in disturbance species was often correlated with a decline in mid-grass species like Needle-and-Thread grass, Northern wheat grass and Western wheat grass.

Table 7 Visible impacts of LWD on vegetation characteristics, at CFB Suffield August 28-29, 2003.

Visible LWD Impacts on Vegetation

Categories	# of Occurrences		Color	Species	Biomass	Density	No Visible Impacts	Total
C (Color)	10	# of Occurrences	10	16	15	10	12	63
S (Species)	16	% of Total	15.9	25.4	23.8	15.9	19.0	100.0
B (Biomass)	15							
D (Density)	10							
No Visible Impacts	12							

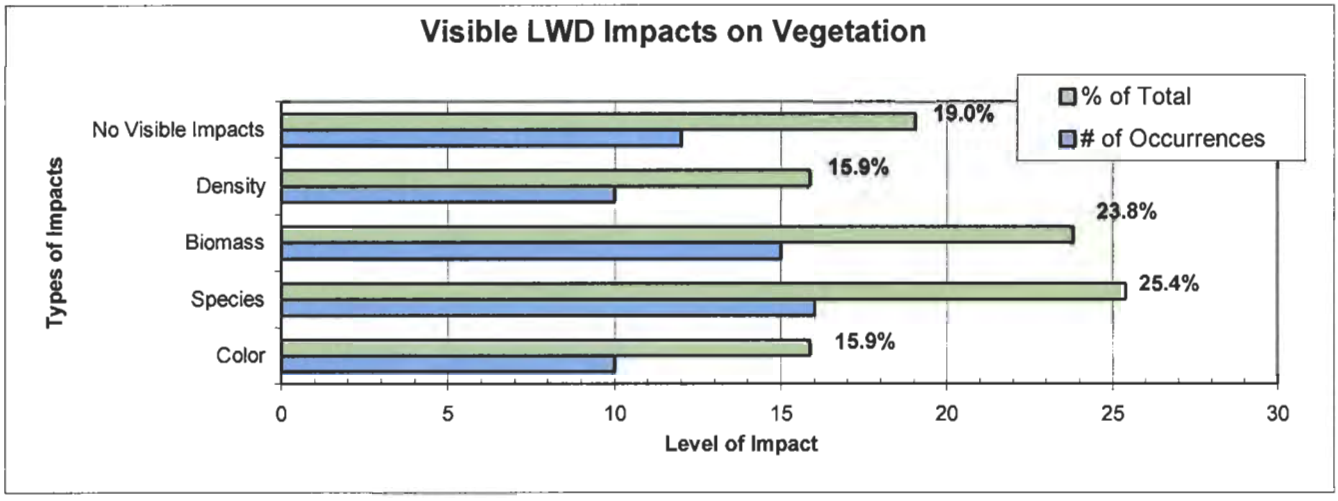


Figure 6 Visible impacts of LWD on vegetation characteristics, at CFB Suffield August 28-29, 2003.

Mechanical Impacts

- Mechanical impacts were observed (Table 8 and Figure 7) on 37% of sites.
- Mechanical impacts were in the form of rutting, tracking and litter compression.
- Mechanical impacts from LWD applications were distinguished by duel tire configuration versus tracked or single tire configuration from military vehicles.
- Twenty % of LWD sites had evidence of rutting with the most common locations being turning areas, the tops of sand dunes and wetlands.
- Tracking was observed on 12.2 % of sites and litter compression on 8.2% of sites.

Table 8 Visible mechanical impacts of LWD o dry-mixed grass prairie at Suffield August 28-29, 2003.

Visible Mechanical Impacts			Rutting	Tracking	Litter Comp.	No Apparent Impact	Total
		# of Occurrences	10	6	4	29	49
Categories	# of Occurrences	% of Total	20.4	12.2	8.2	59.2	100.0
Rutting	10						
Tracking	6						
Litter Compression	4						
No App. Impact	29						

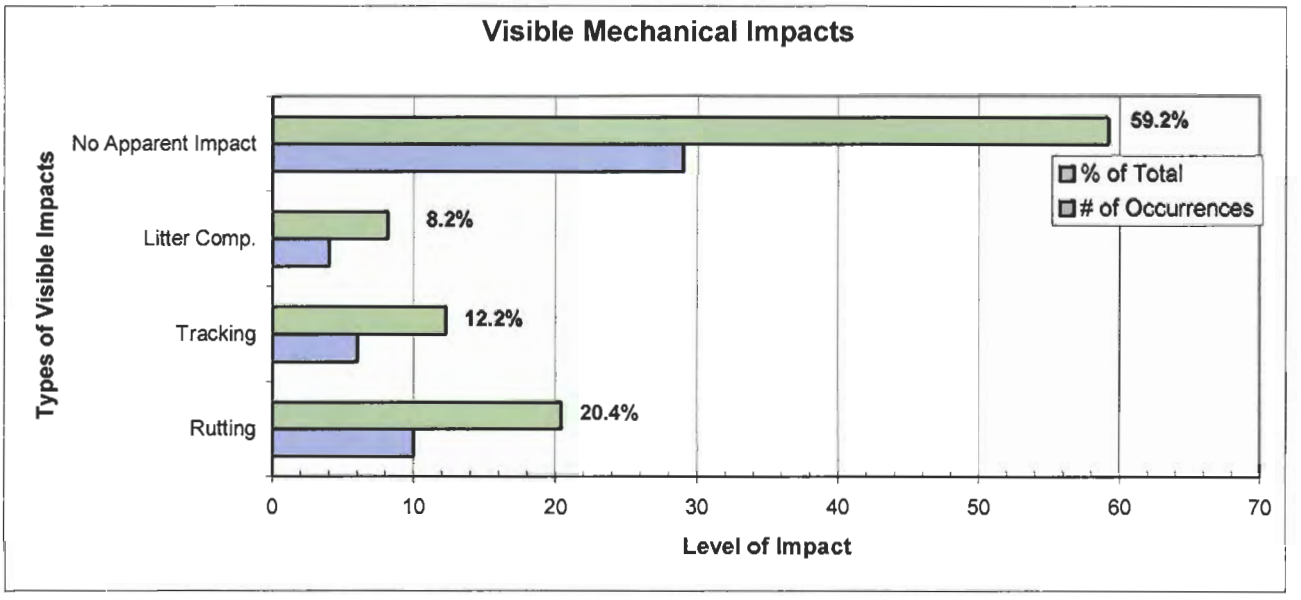


Figure 7 Visible mechanical impacts on dry-mixed grass prairie at CFB Suffield, August 28-29, 2003.

Site Selection

- Site selection problems were observed on 35% of sites (Table 9 and Figure 8)
- Inappropriate sites for LWD application included a) water courses and wetlands – 19% of sites; b) sandy/dune type sites – 9.5% of sites and c) application on steep slopes – 7% of sites.
- Ruts were up to 8 inches deep on several wetland sites where LWD applications took place.

Table 9 Site selection problems for LWD applications at CFB Suffield, August 28-29, 2003.

Site Selection Problems

Site Selections	# of Occurrences
WC & Wetland	8
Sandy Areas	4
Steep Slopes	3
No Apparent Impact	27

	WC & Wetland	Sandy Areas	Steep Slopes	No Apparent Impact	Total
# of Occurrences	8	4	3	27	42
% of Total	19.0	9.5	7.1	64.3	100.0

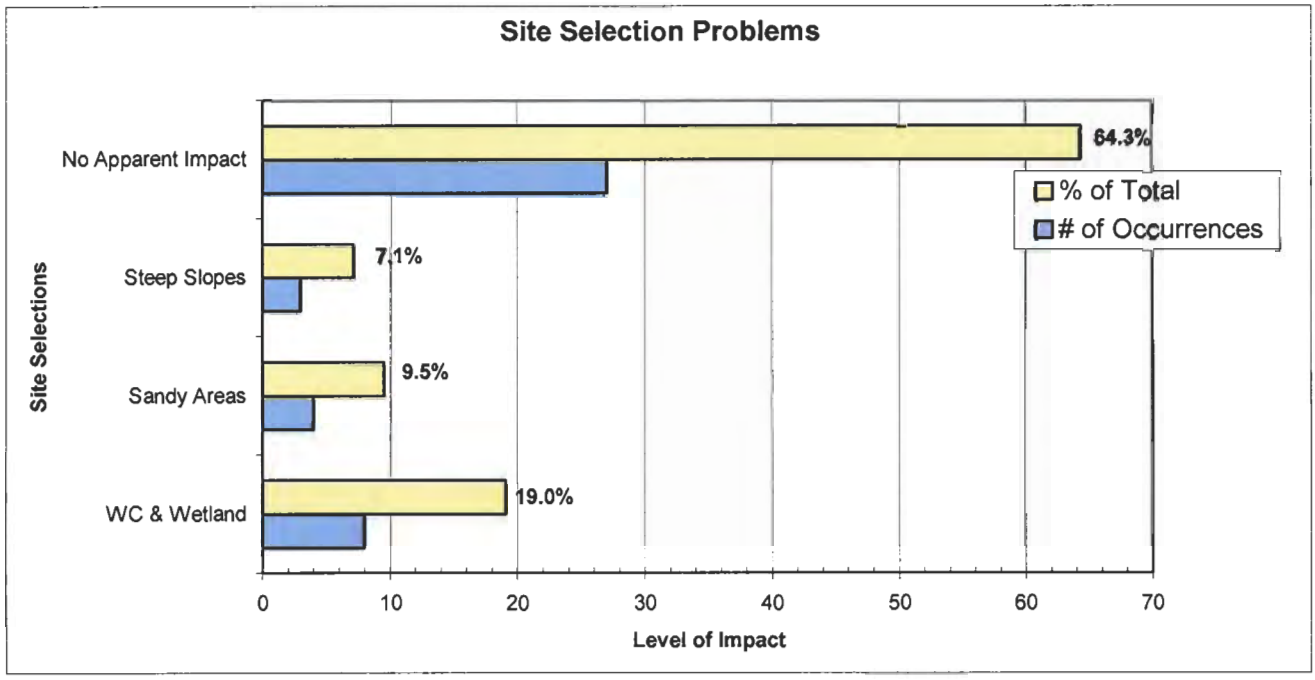


Figure 8 Site selection problems for LWD applications at CFB Suffield, August 28-29, 2003.

Discussion

The main purpose of the Suffield survey was to evaluate the frequency with which residual LWD materials might be found on old LWD sites within the base. The survey also allowed us to observe gross impacts on vegetation where skins and mudpacks of LWD materials occurred, possible mechanical impacts as well as any problems with site selection.

In the Pedocan study, no problems with spread distribution were reported. In this survey, although overall loading rates were reported well within the G50 guideline for winter applications (loading rates ranged between 5 and 20 m^3), evidence of poor LWD materials distribution was common. Residual LWD materials were observed at 86% of the sites evaluated.

The presence of LWD materials could not be attributed to unfavorable precipitation conditions. After the drought of 1999 to 2001 broke, moisture levels in 2002 and 2003 should have been more than adequate to wash away LWD materials – as was apparent in the Pedocan study. The year 2002[8] was the eighth wettest in 118 years (515mm) including June precipitation of 180 mm, the wettest month now on record. In 2003[9], spring and summer precipitation totaled 201 mm, also providing favorable conditions for LWD amelioration. The LWD review process needs to consider the technical or

[8] Source: Atmospheric Environment Service records for Medicine Hat, 2002.
[9] Source: Atmospheric Environment Service records for Medicine Hat, 2003

operational factors that may prevent the even distribution of solids over the desired application area.

A number of impacts on vegetation were apparent where LWD materials occurred as skins or mudpacks. In these circumstances, LWD materials were in evidence as a smothering layer, which could suppress or eliminate the normal mid grass species associated with the range site and replace them with disturbance/weedy species.

In terms of mechanical impacts, the main one of concern was rutting which was observed twenty percent of LWD with the most common locations being turning areas, the tops of sand dunes and wetlands.

Site selection problems were evident on thirty seven percent of surveyed sites that included LWD application through watercourses and wetlands, fragile sand plains, on sand dunes as well as on steep slopes.

2.3 *Alternatives to Landspraying While Drilling*

There are four main alternatives available to conducting LWD on native prairie. These alternatives are discussed in terms of environmental risk with very little consideration given to cost. There is recognition that these alternatives to LWD need to be evaluated in terms of a balance between cost considerations vs. risk levels posed to the rangeland resource.

The four main alternatives available to conducting LWD on native prairie are:

1. Strip the leases and build on-site sumps
2. Construct multi-well remote sumps
3. Utilize more trucks or tri-axle trailers to transport the wastes to agricultural lands for typical LWD
4. Truck liquid waste to a waste management facility

1. **On Site Sumps:** The use of on site sumps requires that leases at least be partially stripped. Native range vegetation is difficult to re-establish, therefore stripping leases presents a serious reclamation problem. Over the past few years, minimizing disturbance on native range has been a primary objective of government, on both public and private lands. Returning to the practice of stripping leases on native range is viewed as regressing although there may still be site specific applications where this will be the preferred method. Road construction on native range, and associated road use, may be reduced by using on-site sumps. The effects of additional travel, such as dust and road kill of wildlife, may also be reduced by using on site sumps although these effects might be mitigated through the use of speed controls and timing restrictions.

2. **Remote Sumps:** Remote sumps provide an opportunity to reduce the amount of disturbance per wellsite constructed, and therefore economies of scale for treatment and mix-bury-cover of drilling waste may be achieved. There is also some flexibility when choosing a site for a remote sump, so the sump can often be placed on less sensitive or more accessible lands so that native prairie is not disturbed. It is common for the drilling waste solids from 30 to 50 shallow gas wells to be accommodated in a 100m x 100m disposal site. Fluids are commonly pumped off and reused on the next well reducing both waste volumes for disposal and fresh water consumption. Flocking and centrifuging[10] provide additional opportunities to conserve water and reduce drilling waste for disposal. A further environmental and water conservation benefit of this method is that produced

[10] The practice of centrifuging drilling waste is a method of both recycling water and reducing the overall volume of drilling waste has been utilized. There are limitations to this option and Industry continues to refine the practice.

water may be used for drilling (as there is no surface disposal) and the need for fresh water for drilling can be reduced or eliminated. There is currently some discussion as to whether there is less or more surface disturbance from remote sumps or LWD operations. LWD presents risks to native range when applied according to the guidelines. When guidelines are not followed, the results tend to be a high degree of impact over a fairly large area. Multi-well remote sumps represent an intensive disturbance on a smaller area, and therefore present similar but less frequent reclamation challenges than on site sumps.

3. **Transport to Cultivation or Tame Grassland:** The third alternative, transporting drilling waste to cultivated lands or tame grass for disposal, is workable in many areas but becomes a challenge as the distance to the agricultural lands increases. This may not be a practical solution for some wells if the hauling distance is long. Another aspect to this alternative is the fact that most of the cultivated land used for drilling waste disposal is private land. There may be a perception by the public that SRD policy is encouraging the disposal of waste originating from wells drilled on Public Land, to private land.

4. **Trucking to Disposal Facilities:** Trucking of drilling waste to a disposal facility eliminates the need to strip lands for sumps and also eliminates the need to expose native range to the risks of LWD. Another possible benefit is that private land will not be used for disposal of "Public Land" drilling waste and therefore the risk of negative perception with the public may be reduced. Trucking drilling waste to a waste management facility is probably the most expensive option.

Current alternatives being used in a number of jurisdictions include:

- In the Special Areas, LWD has been occurring on cultivated land. Not many remote sumps are being used and most operations don't have a long haul distance.
- In the Eastern Irrigation District, LWD for shallow wells is occurring on cultivated land when rangeland for LWD is not available.
- At CFB Suffield, drilling waste has been going into remote sumps when LWD is not available. The Base would rather have waste applied to tame forage such as crested wheat grass than remote sumps.

2.4 Staff feedback - ASRD SE Region - Rangeland Management Branch

On January 24, 2003, a request for review comments of LWD practice on rangelands in southeastern Alberta was relayed to Rangeland Management Branch staff from the Land Use Branch. Seven field staff provided comments. Review comments are compiled by major themes or issues:

Application Rates, Evenness and Record Keeping

- Despite the favorable results reported by Christie et al. (1996) in the Pedocan Land Evaluation Inc. research report, LWD has not been a successful field technique on native rangeland.

- The field studies in 1995 were conducted very carefully. The research land sprays were at light rates and evenly sprayed over the application area, with excellent equipment and operational control.

- Sprays conducted with drilling programs have not had the same level of operational control and are often very uneven. Typically, we observe mud packs deposited at the start of each spread load and then a relatively dilute solution being applied. It is not unusual to find mud packs in excess of one inch thick being dropped at the start of a load.

- Mudpacks from poorly conducted land spray operations kill native prairie and take years to ameliorate.

- Problem land sprays have been left with inadequate clean up.

Planning and Monitoring

- Staff time to process applications, plan and monitor land spray applications has been unacceptably high. The size and complexity of planning area increases dramatically over conventional well sites with LWD.

- Industry has failed to meet mapping and record keeping requirements. Mapping has been non-existent or completely inaccurate with examples of company maps with incorrect GPS coordinates and sites that have received double spray applications over the same land base.

Persistence of Drilling Waste on Rangeland

- In order that impacts from LWD are minimized to native grassland, the sprayed materials should disappear rapidly from the rangeland surface with precipitation events and have no significant masking effect. After eight years of field experience, we now question this assumption. It is clear that the research results were obtained during relatively moist conditions. Precipitation levels were above average during

most of the 1990s (at Medicine Hat, 6/10 years had above average ppt). Research trials that achieved light application rates, also had favorable precipitation events to remove the light spray coverage.

- In the scope of the past eight years, average precipitation to severe drought conditions have been experienced. During this period, staff have observed more evidence of LWD materials persisting on rangeland vegetation for prolonged periods. Drought conditions exacerbate the problem of residue build up.

Impact of LWD on Rangeland Functions

- We have major concerns that persisting LWD materials will increase the temperature regime on the rangeland surface.

- Recent research by AAFC demonstrates the impact that increased litter levels (material with a high reflectance to sunlight) can have to cool the soil surface of grassland environments and make scarce moisture more available.

- Field staff have observed that the dark colored land spray residue (low reflectance of sunlight) absorbs more of the suns radiation and heats the surface of the prairie. In other words, sprayed range will retain heat in much the same way as bare soil.

- On a sunny summer day healthy native prairie will feel cool to the touch while land sprayed areas are hot to very hot. In this moisture-limited environment, increased temperature flux must have an impact. Subtle effects might occur to habitat, wildlife habitat values, and there may be increased potential to negatively impact nesting birds and small slow moving wildlife of which some are considered rare or endangered.

Prairie Wildlife and Species at Risk

- Biodiversity maintenance is a high ranking goal for public rangelands.

- The majority of the endangered species in our province occur within native prairie. The new and evolving planning processes for species-at-risk have not been factored into LWD approvals. Basic questions need to be answered about potential impacts of LWD on habitats of species at risk.

Rangeland Water Supply

- Water resources are increasingly scarce in southern Alberta and the energy sector is under growing scrutiny to conserve water at all phases of production. Alternatives to LWD such as portable sumps, or flocking and reusing water coupled with hauling solids to a multi-well sump (one or two per drill program), have much less impact on the prairie and to dwindling water supplies.

Rangelands – An Environment for Food Production

- We cannot ignore that one of the integrated uses on Public Land is food production. Beef produced on rangelands is considered wholesome and safe. This reputation needs to be safeguarded.

2.5 Staff feedback - ASRD - Fish and Wildlife Division

The following input was obtained through a survey of Fish and Wildlife staff in the SE Region that have worked with LWD:

Although LWD may be one way of reducing some of the footprint from oil and gas activity on the prairie (by allowing for smaller wellsites), any savings at the wellsite may be offset by effects of spraying the sump fluid on a much larger area of native prairie. Concerns include:

- Direct and indirect effects of spraying on wildlife and wildlife habitat. For example, spraying on native prairie can affect the nests, dens and burrows of several species including burrowing owls, long-billed curlew, marbled godwit, numerous species of passerines, waterfowl, and small mammals. There may be implications under the Wildlife Act as the house, nest or den of endangered species (e.g., burrowing owl) are protected throughout Alberta and throughout the year ("shall not willfully molest, disturb or destroy"). There may also be implications under SARA, once the automatic prohibitions (re: killing and harming) and the protection of critical habitat sections come into force on June 1, 2004.

- Difficulties in application (i.e., spraying) on native prairie can result in deposits several centimeters thick that can persist for long periods of time. This can lead to mortality of some plants and invasion by weed species. Information on plants that may be at risk in Alberta is limited at this time; the status of many species is unknown or poorly known. Without this information, even the best planned program may affect some species-at-risk.

- LWD deposits may alter the temperature regime of prairie soil and affect the health of prairie plants in some sprayed areas.

- Effects on vegetation and other resources may be long-lasting if adequate precipitation does not occur soon after application to wash the material off vegetation and into the soil.

- Equipment used for LWD can leave tracks and ruts on fragile soils or in wet areas. Recovery of this damage is very slow.

Given these concerns, the Fish and Wildlife Division recommends the moratorium be continued on LWD with spraying on native prairie, at least for public lands. LWD with

spraying on cultivated lands could be allowed subject to appropriate conditions (EUB). Additional research (e.g., effects on vegetation and ground-nesting birds; alternative disposal techniques) and improvements in equipment and application techniques are needed before consideration is given to removing the moratorium. If LWD is allowed on native prairie, a review of the current policy and development of (new) guidelines needs to be undertaken. Several staff made suggestions for new guidelines or some revisions to the existing policy; we can discuss these later.

There are other practices that industry should be encouraged to use that will also reduce the footprint on native prairie. These include the use of tanks and remote sumps (on cultivated land), use of a common sump for several wells, water recovery from sump with alternate disposal of solids, etc. Many of these practices have been used before. The idea of recovering and reusing water would also be compatible with the recently released Water for Life Strategy.

2.6 Experience With LWD in Other Jurisdictions

2.6.1 CFB Suffield,

Background: CFB Suffield is a military training area that with a land surface area of about 275,000 ha. The Suffield Industry Range Control (SIRC) organization, located on the Base, provides liaison with the military to allow industry to access subsurface oil and gas resources. CFB Suffield employs environmental staff within Range Control that exercise oversight of oil and gas activities along with the Alberta Energy and Utilities Board.

- LWD has been allowed on the base since 2001.
- Rates of ¼ to ½ the EUB rates are applied.
- Base environmental staff have observed problems with LWD operations including:
  - LWD materials are not distributed over the land properly.
  - Problems occur where the operators start and stop.
  - Pooling in low areas has been observed.
  - There is concern over potential adverse effects on Kangaroo rats, other species at risk and ground-nesting species.
  - Base staff have observed improper application around wetlands: buffers are not observed.
  - Base staff suspect there is adverse effect on sandy soils.

- LWD is not allowed during spring to allow migratory birds to nest.
- LWD is only allowed on pipeline rights of way because these lands are used fairly intensively impacted already.

2.6.2 Eastern Irrigation District

Background: The Eastern Irrigation District along with its role as irrigation district manager, also manages 236,000 ha of native rangeland, mostly within a dozen community pastures. The district also acts as land manager in dealing with oil and gas development within the district.

- LWD has been permitted on EID land since 1989. The EID continues to allow LWD to occur.
- The EID tries to encourage application in the winter or after cattle have grazed.
- The EID will not allow application during the active growing season (April to July)
- Rate of application is 12 to 13 cubes per hectare or about ¼ allowed by the EUB.
- The EID has observed no detrimental affect on native range. Staff have observed drilling waste staying on the vegetation for long periods of time with no apparent adverse effect. Since 1989 there have been a number of prolonged dry periods (months).

- The EID closely monitors application and if problems occur they get companies to remediate quickly. Companies are very responsive as they don't want to lose their privileges.
- Practices have improved over the last 3 to 5 years with less problems encountered.
- The EID prefers to apply LWD to cultivated land, but this is not always possible.
- The EID tries keep the drilling waste application site as close as possible to the wellsite, to reduce travel which results in dust.
- Industry has been good at supplying accurate spread maps.
- Some land owners feel the application of LWD is beneficial to their land but opinion is mixed.
- If minimum disturbance is implemented then LWD allowed. If sumps are constructed then no LWD is allowed.
- The EID has tried having industry wash the waste off during dry weather but this does not work. The feeling is the extra traffic on the land is more detrimental than the drilling waste.

2.6.3 Special Areas Board

Background: The Special Areas Board was set up for land use control in the 1930's during the dustbowl period when massive abandonment of farm land resulted. The Special Areas Board is a unique rural municipal area covering approximately 2.1 million hectares in southeastern Alberta. Sixty percent of all lands in the Special Areas are public lands and leased as grazing, cultivation or irrigation leases. The total native range area in the Special Areas is 993,470 ha.

- Special Areas Board does not permit LWD on native prairie because the effects are not known. They are taking a cautious approach.
- LWD is permitted on tame pasture because these areas can be cultivated if adverse effects occur.
- No adverse effects to date have resulted in pastures being worked up although if LWD is permitted, it is a preference to apply it on pastures that will be worked up.
- Special Areas Board does not permit the application of manure on native pasture either.
- Concerns are as follows:
  - Application of bentonite clay on solonetzic soils may result in further degradation of the soils physical properties.
  - Drilling mud appears to heats the soil and plants and may result in lost production and long term change in species composition.
  - Drilling mud may reduce the presence of little club moss which could result in soil erosion. Little club moss is a major component of the vegetation surrounding bunch grasses. Reduced levels of club moss will result in an increase in bare soil and subsequent soil erosion.
  - Long term effects on the native vegetation are unknown.

- The Special Areas Board is concerned about the mechanical impacts from traffic on native range.
- There is also a concern over the potential impact on soil water infiltration rates of vehicle traffic.

2.6.4 *Alberta Energy Utilities Board (AEUB)*

The AEUB has conducted drilling waste audits on 51 LWD sites throughout the Province. The information (paper) audit consisted of a review of information supplied from companies on disposals conducted between 2001 and 2003. Of the 51 audits, eight passed, 18 had warning issued, 24 had "minor" Level One enforcement and one had "major" Level Two enforcement". Most Level One enforcements were due to reporting/notification issues or insufficient sampling points. The major Level Two enforcement action was delivered due to exceeding of the winter spread rate criteria.

Summary - Experience in Other Jurisdictions

The Special Areas Board does not permit the use of LWD on native rangeland while the EID and CFB Suffield allow it with conditions, a number of which exceed G50 guidelines. All three land managers favored the application of LWD materials to disturbed lands including cultivation, tame pasture or roads and pipeline rights-of-way. Both the EID and CFB Suffield restrict LWD application during spring and summer and also require slightly lower loading rates than the G50 winter rate of 20 m^3.

3.0 Discussion and Summary of Review Findings

The review of the LWD file paper trail and of field inspection reports from the Medicine Hat office highlighted a number of failures and problems, which were common to both review components. The most common problem was that of LWD projects being applied outside of the approved area. A number of cases had no final field report, many field plans were of poor quality and not useful in the review process, or, no approval had been obtained for the LWD project. The next most common issue was that of heavy loading rates of LWD materials. Finally, siting problems were common to both review components with LWD materials being applied through watercourses, on high value wildlife habitat like sagebrush cover and on fragile sand dune sites.

The survey of sites within CFB Suffield highlighted concerns about the commonly observed presence of residual LWD materials despite adherence to EUB loading guidelines and suitable precipitation levels in 2002 and 2003 to wash away solids. The LWD review process needs to consider the technical or operational factors that may prevent the even distribution of solids over the desired application area. Smothering of grassland vegetation was apparent where LWD materials occurred as skins or mudpacks on spread sites. Mechanical impacts like rutting were observed in turning areas, on the tops of sand dunes, and in wetlands. Site selection problems were also noted through watercourses and wetlands, fragile sand plains, on sand dunes, as well as on steep slopes.

CFB Suffield requires that LWD materials be applied to existing road and pipeline rights-of-way to so that spraying is confined to already disturbed areas.

Four alternatives to LWD on native prairie were outlined, including conventional sumps, remote sumps, transport to cultivated land or to a disposal facility. More information on the economics of these practices will aid in their evaluation.

Most of the issues highlighted in the file review and field survey were also mentioned in staff comments, including adherence to the approved spray area, problems with spread distribution, site selection problems and record keeping. In addition, PL staff raised many questions concerning the operational control of LWD and governments ability to deliver on compliance assurance. LWD seems to be an operationally complex activity with many potential weak links in the chain of events leading to success (mapping, record keeping, application equipment, operator understanding of goals, project supervision). A comprehensive review process should be implemented for LWD, including a consideration of species at risk legislation and requirements. More research is required to look at the impact of persistent LWD materials on the rangeland ecosystem.

Across other jurisdictions, experience with LWD was mixed. Two of three land management agencies interviewed expressed concerns about LWD. The Special Areas Board allows LWD on tame pasture but does not allow it on native prairie, wishing to take a cautious approach on the technique until more is known about it's potential negative impacts. Environmental staff from CFB Suffield also expressed concern with LWD but allow the practice to continue at reduced loading rates. CFB Suffield is an active participant in the this review process and normally works in sync with policy direction set by ASRD on industrial practices. The Eastern Irrigation District has a relatively high comfort level with the practice but maintains strong control over timing to avoid applications during the growing season. The EID prefers to have LWD occur on cultivated lands. Applications to rangeland occur after the growing season, after cattle have grazed the range, and at reduced application rates of 12 to 13 m^3.

This review identifies numerous problems with LWD while the Pedocan study showed very favorable results in terms of limited impact to range resources. These contrasting results need to be reconciled. The Pedocan study was a field demonstration of a new practice on a relatively limited number of sites with careful control over site selection and landspraying operations. The landspraying treatments in the Pedocan study appear to have been carried out with careful attention to spray distribution, to equipment and with adequate field supervision. The Pedocan study was also carried out during a period of normal precipitation that facilitated the removal of landsprayed solids from the range vegetation. In this review of LWD practice, a greater appreciation is gained of the shortcomings of LWD in an operational setting with a full range of variability in climatic conditions including drought. A significant number of problems and issues have been identified through the review of hundreds of project files and field reports, from a field survey of project sites, from the experience with LWD in other jurisdictions and from the experience of departmental staff.

The file review and field observations revealed that on a high percentage of sites, LWD is not being conducted according to the guidelines and is having a negative impact on native range. The current LWD policy needs to be revised, with stakeholder input, to address these operational concerns.

From the review it is apparent that drilling waste applied under the LWD persists on native range longer than previously thought and may have negative impacts on native prairie even when applied according to the current guidelines. Further research will need to take place to determine the exact nature of these impacts.

4.0 Landspraying While Drilling on Native Rangeland - List of Issues

After reviewing the available data and inputs, the LWD Review Team identified the following key issues which were grouped as administrative, operational, or environmental related issues.

Administration Issues

- Lack of notification by industry on where and when LWD occurs.
- Poor documentation of locations, accuracy, readability, type of reporting. Inadequacy of referral mechanism.
- Inadequacy of referral mechanism
- Assigning an appropriate disposition type and associated consents to LWD activities.
- Cost recovery for administration - fair return of use.
- Industry accountability for revisions when project amendments occur.
- Enforcement [and role of other agencies in this].
- Closure mechanism for file: what are the requirements?
- Creation of tracking mechanism [self reporting vs. our reporting].
- Industry requirements.
- Penalties for violations under the Public Lands Act.

Operational Issues

- Compliance
- Evenness of spread distribution
- Lack of qualified operators and supervisors
- Improved technology and equipment [innovation]
- Best management practices
- Alternative handling methods

Environmental Issues

- Site suitability

- Timing
- Wildlife considerations
- Water consumption
- Thermal impacts
- Grazing conflicts
- Growing season conflicts
- Endangered species effects
- Adaptation of LWD to drought conditions
- Loading rate of drilling mud
- Plant succession
- Litter compression
- Hydrology/infiltration
- Animal health/human health
- Public perception
- Aesthetics
- Recreation impacts

5.0 LWD Review: Key Recommendations - Framework for Engaging Industry and Stakeholders

Results of the LWD Review reveals a number of operational deficiencies. Reservations about the practice have been expressed from a variety of jurisdictions. The review committee feels that issues and operational deficiencies must be addressed before LWD can be resumed on native prairie. The following recommendations address both internal and external factors that must be addressed and will provide a framework for discussion with industry and stakeholders. In addition, recommendations for further research are included to help establish a higher level of confidence that LWD does not adversely affect native range, should the practice be reestablished in the future.

The committee recommends that its mandate to review LWD continue past January 1, 2003, and that industry and stakeholders be engaged to begin a process that will lead to the issues identified by this review being resolved.

There are four main areas in which recommendations will be presented:

- **Administrative recommendations** deal with administrative and legislative process on public lands, and the interface between management of LWD under the Public Lands Act and other legislation.
- **Operational recommendations** address current practice and acceptable standards given current knowledge.
- **Environmental recommendations** capture the environmental effects of LWD on the landscape and biotic organisms.
- **Research recommendations** address the current unknowns associated with the impacts of LWD.

Administrative Recommendations

1. In order to clearly know where and when LWD is occurring, and to improve quality of planning and ability to integrate with other land uses, proposed LWD siting should be submitted in conjunction with the associated MSL application. Temporary Field Authority's for LWD should be reviewed for suitability.

2. A new disposition tool is required to effectively and easily administer LWD tracking and approvals. This tool should be tied to the MSL associated with the LWD.

3. LWD information should be included with the EFR. This includes a reporting of any other interests or reservations on the land base and an explanation of how these will be addressed, an explanation of contingency plans if LWD is not available, and the obtaining of consents from other interests, based on their land-standing information.

4. Where an Area Operating Agreement is being proposed, the detailed plans for associated LWD should be included as the agreement is developed.

5. A minimum quality of documentation needs to be established and enforced. Plan standards need to be developed that will describe the exact location proposed for LWD. A suggestion is that a digital shape file be affixed to the MSL application. A post-disposal description of the area and shape of the spray area used must be provided in a similar format after application.

6. Referral mechanisms for LWD must be defined for staff to insure that other agencies concerns are addressed.

7. Mechanisms for enforcement of situations such as unauthorized use need to be addressed and clarified. This would most likely be handled through contravention of conditions enforcement. An internal Public Lands review should be conducted to assess and track submission information.

8. Procedures outlining the requirements for post application inspection and reporting need to be developed. This process will insure industry revisits each site to evaluate the impacts and will also allow for closure of files. A time limit (2 years suggested) for application for a "letter of clearance" should be imposed.

9. A tracking system needs to be developed an implemented to insure adequate follow up by both industry and government staff occurs. GLIMPS may be considered as the tool of choice for managing these dispositions because of its availability in the white area. The capability to attach digital shape files to applications should be developed.

10. Public Lands LWD requirements should be identified and included in the current re-draft of EUB Guide 50.

Operational recommendations

1. Industry should develop best management practices to provide guidance to themselves in how to meet the current standards. (Guide 50 and Public Lands policy) Currently, industry has difficulty meeting standards for evenness of application [films and mud packs]; rutting; and avoidance of application on steep slopes; in wetlands, watercourses, and on sensitive sites like sand dunes or high-value sagebrush cover.

Environmental recommendations

1. AGRASID parameters/soil types should be used to produce classification rules to indicate where LWD can and cannot be conducted. This will protect range sites were LWD is not appropriate. Note that under current guidelines LWD cannot be applied to sand dunes, sagebrush habitats, Badlands, river breaks, watercourses, and wetlands.

2. Issues with wildlife, high surface temperatures, grazing and growing seasons, and endangered species can for the most part be addressed by timing. A timing window of October 15th to March 31st is proposed. Note that issues with plant succession, litter compression, animal and human health, public perception, aesthetics, and recreational impacts can also be addressed by timing restrictions.

3. A drought index should be developed that will indicate when LWD can safely occur and when it can not. Precipitation should be monitored. If conditions occur that cause materials to persist, the crown reserves the right to suspend LWD operations on public lands.

Research recommendations

1. A study to examine the effect of a full spectrum of loading rates on native vegetation should be initiated. Parameters to be examined include the effects on plant succession, the effect of thermal changes, and hydrologic effects such as infiltration rate changes.

2. The study of animal health effects of LWD can be linked to a current study being conducted by Oil and Gas Company Energy and Agriculture Canada. This study will link drought conditions and loading rates as well as surface thermal dynamics.

3. The recommended application level of 6 tonnes per hectare should be checked to ensure there are no issues associated with that rate.

6.0 References

Alberta Energy and Utilities Board. 1996. Guide 50 – Drilling Waste Management. 143 pp

Christie, J.L., L.J Knapik and D. Walker. 1996. Effects of drilling waste application on native prairie in Southern Alberta. Pedocan Land Evaluation Ltd. 96 pp