PIPELINE RECLAMATION CRITERIA DEVELOPMENT IN ALBERTA

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ABSTRACT

Discussions regarding assessment of reclamation success following various land disturbances have been ongoing for a number of years in North America. In Alberta the emphasis was initially focused on coal and oil sands mines. This was followed by discussions on how to assess oil and gas wellsites and pipeline reclamation success. The objective of reclamation is to have equivalent land capability at the time of application for a reclamation certificate on the disturbed land. The traditional approach for wellsites has been to use an individual parameter-by-parameter comparison and pass/fail system. This was also proposed for pipeline reclamation. Some in the industry felt that there were different approaches possible to evaluate equivalent land capability. NOVA Gas Transmission took the lead in putting together a team of people (NGTL Soils Advisory Board) from other companies, various government regulatory groups, consultants, and personnel from Agriculture and Agri-Food Canada, Alberta Agriculture, Food and Rural Development and the University of Alberta. The objective is to develop a relatively easy-to-use, cost-effective reclamation evaluation tool. Various approaches were field tested in fall, 1997. The approaches were revised and will be field tested in additional geographic areas of Alberta in 1998. This paper describes the process and progress to date.

Introduction

Pipelines have been used for transporting a variety of substances, especially water, for many years. More recently they have been used to transport natural gas and oil. Mutrie and Gilmore (1995) estimated that Alberta has over 2,000,000 kms of pipelines in the ground. Most people are not aware of the presence of pipelines because they are generally buried and so are rarely seen as the soil over them continues to support pre-disturbance activities such as agriculture, forestry, urban and rural communities, and wildlife habitat along with other activities. However, as more people have become aware of the environment, there has been an increasing concern about the impact of pipelining.

With this environmental concern about the impacts from construction of pipelines has come legislation governing their construction, operation and decommissioning. Within Alberta there was no legislated requirement for the reclamation of disturbed lands prior to 1963 when the Surface Reclamation Act was proclaimed (Brocke, 1988). Ten years later, in 1973, the Land Surface Conservation and Reclamation Act was proclaimed. This new Act required that environmental protection and reclamation be part of the development planning (Landsburg and Fedkenheuer, 1990). A review and approval system that included Environmental Impact Assessments and Development and Reclamation Approvals was implemented. Subsequent changes were made in 1983 and more significantly in 1993 with the passage of the Alberta "Environmental Protection and Enhancement Act" (Alberta Environmental Protection, 1994).

It is important to note that, in Alberta, there are Class 1 and Class 2 pipelines. Class 1 pipelines require a Conservation and Reclamation Approval, while Class 2 do not require government approval to construct them. The dividing point is an index value of 2690 (pipe diameter in mm x length of the pipeline in kms). Class 1 pipelines are those greater than 2690, while Class 2 pipelines are less than 2690. It is important to note that both classes of pipelines require a reclamation certificate upon abandonment.

Legislation also brought the requirement to return disturbed land to an equivalent land capability at the time of abandonment. Equivalent land capability is currently defined as, "The ability of the land to support various land uses after reclamation is similar to the ability that existed prior to any activity being conducted on the land, but the ability to support individual land uses will not necessarily be equal after reclamation" (Powter, 1998).

If the requirement is to have equivalent land capability at the time of application for a reclamation certificate, there is a need to be able to measure equivalent land capability. Some documentation is required to enable the regulator to acknowledge that the area is suitably reclaimed and to release the proponent from further reclamation liability, as well as to assure the public that a suitable reclamation job has been done. This documentation has been difficult to obtain agreement on and it has been the subject of much discussion since the mid-1980s. The definition of reclamation success and how to measure it was the topic of a workshop in 1992 (Mahnic and Toogood, 1992). Following the workshop, focus shifted to oil and gas wellsite reclamation criteria development for several years where a parameter based checklist was developed and used. For these areas, specific individual parameters are compared on and off the wellsite and each must pass or the site fails.

There has been a desire by some to utilize this system for pipelines as well. Others have suggested using a capability rating system such as has been used in the agricultural area for many years. It is recognized that some modifications may be required to either system if they are to be applied to pipelines. These two approaches reached a stalemate in 1996. It was at this point that NOVA Gas Transmission offered to take the lead in developing a land capability rating system so others could better see what it might contain, how and if it might work better for pipeline reclamation assessment. This paper addresses the approach used and the results of the approach.

Why Have Standards

As discussed previously, once there is a requirement in place to return land to an equivalent land capability at abandonment time, there is a need to be able to assess whether this requirement has been met. In a manner similar to a coal mine, it is useful to know how one's reclamation is going to be assessed at the "end of the day". In this way, during pipeline construction planning and the operation of the pipeline, the operator, the regulator and the public, are always aware of what the end goals are and can plan reclamation activities accordingly to meet the requirements.

We believe it is in the interest of all parties to have standards in place that are both scientifically meaningful and achievable. This gives industry an opportunity to meet or exceed those standards and provides an opportunity to improve construction and operating practices and further minimize any environmental impacts. With the current status of no pipeline reclamation standards in place, the operator does not know what to focus on at the various stages of a pipeline (construction, operation, retirement). Having standards in place helps the regulatory bodies and the general public as they know what is focused on in the pipeline industry. Also important in today's financial world, the reclamation liability at any one point in time can be very difficult to determine. This has very significant cost implications for industry as reclamation liabilities have the potential to significantly limit a company's borrowing power, the overall balance sheet and the environmental report card. These are important items for a company such as NOVA Gas Transmission Ltd., with over 22,000 kms of pipe in the ground.

Implications

It is not clear what the status of pipeline reclamation in Alberta is. It is not known if 50 percent of pipelines should fail reclamation evaluations or whether 5 percent should fail. Based on the number of kms of pipeline in the province and the small number of landowner complaints, some individuals feel the true failure percentage is quite low (15 percent or less). Others suggest it may not be so low. Generally there seems to be agreement that pipelines have fewer reclamation problems than wellsites. However, it is clear that the cost implications of a poorly designed reclamation evaluation system are large.

Employing the wellsite criteria, as some have suggested, has the potential to be a large cost to industry and the public. For example, it has been estimated that the cost of using a wellsite type approach for pipeline reclamation assessment would cost as much as $2,000 per km or $20,000 for a 10 km line. Using these figures, if all the 2,000,000 km of pipelines that Mutrie and Gilmore (1995) estimated were in the ground in Alberta were to be assessed, the cost would be about $4 billion in current dollars. This is just the cost to find out whether, according to wellsite-like reclamation criteria, a pipeline is suitably reclaimed. Some feel that there are more cost-effective approaches which can do a very good job of evaluating whether equivalent land capability has been met.

In addition to the direct assessment dollar costs there are other implications. The NGTL External Soils Advisory Board identified some of the important components of a pipeline reclamation evaluation tool as: being easy to use; having scientific validity; providing reproducible results; being cost-effective; measuring the important environmental parameters; and, defining how to measure those environmental parameters. If a system can not achieve these items, there is a risk that significant parameters will not measured and may need to be measured at a later date (increased cost) or there are potential environmental liabilities which may not be addressed (increased risk). If the results are not reproducible there will likely be costs associated with litigation as different investigators working for various involved parties arrive at different results. Scientific validity is a requirement for the system as without it there will likely be litigation as various parties dispute the methodology and end results. There are many environmental parameters which can be assessed, some of them very costly, and so it is important to key only on those of significance for addressing whether equivalent land capability has been met. Otherwise valuable time and people resources are being wasted.

The point is, reclamation evaluation standards must be well thought out so that what needs to be assessed, is, and that solving one issue doesn't create unwarranted new issues. It is imperative that government, industry and the public approach the development of reclamation standards from the perspective of what really needs to be assessed in order to ensure we have equivalent land capability at pipeline abandonment time.

Standards Alternatives

There are currently two reclamation evaluation systems presently in use in Alberta, one for oil and gas wellsites (wellsite criteria) and another on mines (a modified agricultural land capability system). Both systems use many of the same landscape, soils and vegetation parameters, however use of the individual parameters is different.

Generally for wellsites, the single most limiting parameter is used to determine whether a site passes and receives a reclamation certificate or whether it fails and must undergo either active or passive remediation before it can be again considered for reclamation certification. Examples of single parameters that can fail a site include: topsoil depth, topsoil colour, admixing of surface and subsurface soils, pH, electrical conductivity, organic matter content, weeds, crop vigour and soil texture. The wellsite criteria system does not take into

account any parameters which might have been improved as a result of pipeline construction, for example, elimination of a hardpan, improved pH, or improved texture which can offset degradation of the capability of the land. Instead, the entire wellsite can be downgraded based on one parameter taken in isolation.

In the mining industry a system is used which combines landscape, soils and vegetation parameters to come up with a capability rating. In this case, reclamation assessments take critical soil, landscape and vegetation parameters and rates them for improved or reduced levels and these parameters are used to develop an overall reclamation rating of the site. In this approach, some trade-offs are possible as some parameters may be made better as a result of pipelining and these are taken into account when evaluating whether a site has attained equivalent land capability at the time of pipeline abandonment. It is felt, by some, that this is more the way vegetation views the pipeline disturbance at the time of application for a reclamation certificate.. That is, equivalent land capability doesn't necessarily mean that all parameters must be the same as they were prior to pipeline disturbance, but it does mean that the end result must be equivalent land capability. Under the capability systems developed and used in the agricultural sector for many years, class boundaries are 15 to 20 points apart depending upon whether they are on the higher or lower numbers. For use in pipeline reclamation success evaluation it is proposed that if a site on the pipeline right-of-way is within 15 to 20 points of the off right-of-way similar area control, the site has been returned to equivalent land capability.

The Process

Pipeline reclamation standards were discussed since the mid-1980s in Alberta with an ebb and flow in the intensity of discussions, all of which led to a pipeline reclamation success measurement workshop in 1992 (Mahnic and Toogood, 1992). Following this meeting emphasis shifted to developing reclamation criteria for assessing reclamation on oil and gas wellsites. There were a large number of wellsites classified as abandoned, with many of them classified as "orphaned" (no traceable owner) and there was a desire to get wellsites certified more quickly in the future, while the ownership was still clear. As the rate at which new wells were being drilled each year increased, there was concern that the abandoned wellsites needed to go through the certification process so they could be "taken off the books" of both industry and government. Of major concern also, was the manpower requirement to complete all of the certifications.

In 1995 interest in reclamation standards for pipelines again began to increase. Several joint government-industry working groups were established. In mid-1996, a version of the wellsite reclamation criteria was modified and tabled for consideration as pipeline reclamation criteria. As discussed earlier, the wellsite criteria are basically a parameter-by-parameter pass or fail system.

To deal with the issue of developing a capability-based assessment of pipeline reclamation, a varied group of people were required around the table. A group of people consisting of representatives from government regulatory bodies, industry and also some independent experts, was invited to participate. The group was formally named the NGTL (NOVA Gas Transmission Ltd.) External Soils Advisory Board and consisted initially of: Adolf Bruneski, Forest Management Division, Alberta Environmental Protection; Jim Burke, NOVA Gas Transmission Ltd.; Dr. Al Fedkenheuer, NOVA Gas Transmission Ltd. (Chairperson); Heather Gerling, Public Land Management Branch, Alberta Agriculture, Food & Rural Development; Tom Goddard, Conservation and Development Branch, Alberta Agriculture, Food & Rural Development; Vasile Klaassen, PanCanadian Petroleum Limited; Len Knapik, Pedocan Land Evaluation Ltd.; Leonard Leskiw, Can-Ag Enterprises Ltd.; Dr. Anne Naeth, University of Alberta; Dr. Wayne Pettapiece, formerly with the Research Branch, Agriculture and Agri-Food Canada; Chris Powter, Land Reclamation Division, Alberta Environmental Protection; and Rob Staniland, Talisman Energy Inc. Dr. Naeth and Len Knapik withdrew from the committee due to time availability constraints.

A key component of this board is the members not directly involved in industry, government or consulting, particularly, such people as Tom Goddard and Dr. Pettapiece. They have brought both a practical and scientific perspective to the Board, as well as considerable experience. For example, Dr. Pettapiece has worked for many years in the area of assessing land capability.

A key activity in the early meetings of this board was to provide everyone with a minimum level of understanding of the problems in pipelining, and to have members put forth their issues and create discussion around each issue. These issues were either included for further discussion or "parked" for bringing to the attention of others. During this process discussion became more open and a framework for working the reclamation standards issue was developed.

The Board agreed that it's primary short-term objective was to work to develop a pipeline reclamation evaluation tool. There was much discussion as to when this tool would be applied, either at post-construction or upon abandonment of the pipeline or at both times. It was agreed that the Board would focus on abandonment standards, those which would be applied at the end of the life of a pipeline. In this way, the operator would know, in the planning stages of construction, what would be measured at the end. This would encourage good planning of soils handling and other environmental issues during construction in order to minimize the cost over the life of the pipeline.

Important components of the reclamation evaluation tool are seen by the Board to be: that it is scientifically valid, relatively easy to use, cost-effective, provides reproducible results, measures important environmental parameters and defines how to measure those environmental parameters. It was also a desire that time not be spent initially building new systems but to evaluate systems and processes already available. The Board has met a number of times over the past months to set goals, objectives and timelines and to develop the approach to use. In the end, it was decided that a visual assessment as well as a couple of others, one with a more detailed level than the visual, but not requiring laboratory analyses, and another requiring laboratory analyses needed to be developed. As well, the Land Suitability Rating System (Agronomic Interpretations Working Group, 1995) and a version of the wellsite reclamation criteria system (Wellsite Criteria Working Group, 1995) were used. Along with these systems, a landowner reclamation evaluation form was also developed; this is currently being tested with landowners who were in the 1997 and 1998 field tests.

Following agreement on the systems to use, the Board retained three senior consultants to take the systems to the field and evaluate their field performance. This was done in October and November, 1997. The consultants were sent to three areas of the province and asked to employ the systems on five pipeline segments, chosen by representatives of the Board, in each area. The consultants were not to be on the same site at the same time, nor were they to discuss their findings with each other until after their reports had been submitted to the Board. One day was spent in the field by the Board and each consultant was visited at a different pipeline location. Subsequent to the receipt of the reports, three members of the Board undertook to summarize the consultants reports into one summary report.

The Board then took the results of the 1997 field evaluation and the consultants recommendations and revised the evaluation tool for a re-test in the field season of 1998. A three step process has resulted. One step is the landowner reclamation evaluation form which reflects the parameters being assessed by consultants. The other steps are being done by consultants and involve two levels, the first being a more quantified version of the visual system and the second a modified version of the Land Suitability Rating System. The intent is to again do a summary report and revise and hopefully finalize the systems during the winter of 1998-99.

The larger percentage of the direct funding of the consultants and other activities has come from NGTL, with significant funding also coming from the Canadian Association of Petroleum Producers. The latter is a group of oil and gas producers.

Results

Accomplishments of the Board to date consist of: development of Board objectives, an evaluation tool framework, tool parameters, and an evaluation process; completion of a field evaluation study in 1997, initiation of the 1998 field study using three external consultants in each year; comparison of seven systems initially in 1997 and comparison of selected modified systems in 1998, and the development of a summary report of the 1997 field study.

Specific 1997 results from the field study are:

- agreement on pass/fail results among the three consultants who visited the same sites was less than 45 percent in all of the reclamation evaluation systems tested in 1997, except for the Visual system where there was about 90 percent agreement,

- across the 18 quarter section in the study, the average topsoil depth was 16 cm (+/- 8 cm) both on and off the pipeline right-of-way. Topsoil depth recordings by the consultants reflected this natural variability as one consultant reported finding 10 to 26 cm of topsoil, another reported finding 10 to 19 cm and the third consultant reported 12 to 26 cm. These readings were all for the same quarter and were done by well-qualified soils professionals. Again, this was the natural variability on an agricultural field,

- topsoil thickness alone is a poor indicator of reclamation success as systems that relied heavily on topsoil depth as a measure of reclamation success had failure rates of greater than 40 percent based on topsoil depth by itself. For example, the Wellsite Criteria Access Roads system had a failure rate of over 40 percent due to topsoil depth alone.
- This should not be surprising when the natural variability, discussed in the previous point, is taken into consideration,

- removing the topsoil depth parameter resulted in failure rates of about 15 percent,

- the visual parameters caught about 73 percent out of 183 right-of-way transect failures. This means many of the failures were apparent to the evaluator before subsurface parameters were evaluated,

- two out of the three consultants recommended the Visual System and the Land Suitability Rating System (LSRS) be retained and modified for further field testing in 1998. This was done, and is what the consultants are using in the 1998 field study.

A Landowner Reclamation Form has also been developed, employing similar parameters as the Level 1 part of the system. This form is being given to the landowners on whose property the 1997 and 1998 field study was conducted. When returned, the landowner responses will be compared to the consultant findings. The reasons for this are twofold. One is to see if the parameters important to the landowners have been included in the Level 1 and the second is to evaluate the possibility of using the landowner as the first step in evaluating reclamation on the property. The concept is that the landowner (or the occupant) is working the land and should have a good long-term understanding of the state of the pipeline reclamation. This would conceivably give the landowner an integral role in the reclamation certification process. The role of the landowner in the

reclamation certification process has not been fully investigated to date, however, their input and expertise is an important resource that the NGTL External Soils Advisory Board is attempting to tap with this step.

Conclusions

In conclusion, the following are some key items that have been important in getting the NGTL External Soils Advisory Board to the point where it is today:

- Team building. This project has been underway for two years with part of this time spent being necessary for the group to learn to effectively work together and build trust. Often the problem which needed to be dealt with and overcome was philosophical in nature and not technical. A number of ideas have been brought to the discussions and carried forward to be tested in the field.

- A key to the group's success has been taking the time to separate out issues. For example, taking time to separate construction issues from evaluation of equivalent land capability issues upon abandonment, and then deal with them individually and not try to answer all the questions at one time, in one meeting.

- Another key to the group's success has been the presence of independent participants around the table. This is in addition to government and industry stakeholders. These independents have brought a third party point of view to the discussions without the bias (real and/or imaged) of the other government and industry members.

- Landowners are an important source of input and expertise and ways are being investigated to obtain and make use of their input.

- Also important is the presence of a chair, or facilitator, to keep the group focused and moving along, while checking to keep everyone participating and comfortable with the proceedings.

- Field testing. Work is continuing on developing a proposed system, using small scale field testing, before implementing the system on a large scale across the province.

There have been many difficult issues, with many still to be resolved. The Board is, however, working to simplify the systems to be used and yet keep them meaningful and valid. How to best answer the question of when is a pipeline successfully reclaimed and when does a pipeline truly require additional remedial work, is still being discussed. However, with the interest and participation experienced to date, we are confident that government and industry, working together with the public, can solve the issues around pipelines and associated facilities reclamation certification.

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