

REPORT

STONY CREEK CAPITAL PROJECT EVALUAT-
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REPORT RAPPORT



STONY CREEK

CAPITAL PROJECT EVALUATION

EA-HQ-83-17

Prepared by R.M.L. Holden

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STONY CREEK CAPITAL PROJECT EVALUATION

Executive Summary

In keeping with Departmental Policy and Treasury Board Policy Directive 148 - Cost Control of Projects a capital project evaluation was completed on the Stoney Creek Sewage System Project constructed during 1980-81. This evaluation took place at the B.C. Regional Office, the Prince George District Office, at the site, and was conducted by R. Holden of the Technical Services and Contracts Branch and L. Nelson of the Capital Management Directorate during the week of January 10-13.

The evaluation and the subsequent report followed the terms of reference forwarded to the region on November 22, 1982 and specifically addresses those items (a) to (h) under the heading of purpose. The evaluation team has concluded that the project was well planned, properly administered, of acceptable quality, met all administrative requirements, was within budget and, satisfied both the users and clients needs. However of concern to the evaluation team was the excessive overdesign of the lagoon and lack of response time on the part of headquarters in obtaining Treasury Board contract approval which may have contributed to a time extension of the contract into 1981.

The regional staff were well prepared and most helpful in resolving problems that arose in reviewing the 32 files and 5 technical reports directly related to the project. The Prince George District and Stoney Creek staff extended a similar co-operation.

In summary the review team is satisfied that the project was completed in accordance with Treasury Board and Departmental Management policy directives and guidelines with due regard for time, quality, cost and the satisfaction of program and project objectives. The region is also to be commended for the excellence of their completion report.

The band having participated in all phases of the project is satisfied that they have received a quality product with low maintenance costs and feel that this project will be a solution to many of the previous health problems on the reserve.

1.0 INTRODUCTION

During the week of January 10 to 14, 1983 a capital project evaluation was conducted on the Stony Creek Sewage Project as defined in T.B. Project Approval No. 768861 of January 18, 1980. The region was contacted during November 1982 providing details of the evaluation in the form of a covering memorandum, Terms of Reference and a checklist all attached as appendix 1.

1.1 Purpose

The purpose of the evaluation was to assess the effectiveness of the capital project delivery system with respect to:

- a) the attainment of overall project objectives;
- b) the effective use of available resources;
- c) cost and schedule control;
- d) responsiveness to users needs;

- e) quality of workmanship;
- f) adherence to policies, standards, guidelines and specifications;
- g) deficiencies and problems; and
- h) recommendations affecting future projects.

and as stipulated by T.B. directive 148 - Cost Control of Projects.

1.2 Objective

The objective of the evaluation was to focus on the features of the project delivery process that contributed to the effectiveness of the project in order that those features may be repeated in future projects as well as identifying and making recommendations concerning features of the project that should be avoided in future projects.

1.3 Scope

The scope of the capital project evaluation involved a review of material previously forwarded to Headquarters, review of regional files, discussions with regional officials, site inspection and discussion with Band staff and representatives and a debriefing with the Regional Director of E & A. The checklists previously sent to region were used as a guide in file review and discussions to identify problems and areas of concern.

The evaluation team was comprised of Mr. R. Holden as the Team Leader of the Technical Services and Contracts Branch and Mr. L. Nelson of the Capital Management Directorate.

Those interviewed at Regional Office were as follows:

D. Clegg	Regional Director of E & A
J. Yong	Project Manager
V. Knight	Deputy Project Manager
A. McConnell	Capital management Co-ordinator

Those interviewed at the Prince George District Office were as follows:

J. Fleury	District Manager
J. Goldie	District Superintendent of Band Operations
P. Errmann	Technologist

D. Liscum, Band Maintenance Supervisor was interviewed at the site.

Note: The Band Administrator due to unforeseen circumstances was not available.

2.0 PROJECT HISTORY

Stoney Creek Indian Reserve of the Prince George District is located 75 miles from Prince George B.C. and about 8 miles south of Vanderhoof. Present on-reserve population is 310 in 55 houses. See map on page opposite.

During the 1970's this reserve became the focus of attention in the media and resulted in exchange of memoranda between various federal Ministers and M.P.s due to outbreaks of disease on the reserve. The apparent nature of these diseases included cases of tuberculosis, skin problems, hepatitis and bowel disorders. After several meetings with the Band and N&HW it was decided that the cause of these problems was the lack of adequate sewage collection and treatment facilities.

Planning and pre-engineering feasibility studies by the Department commenced in 1978 to address cost, timing and best solution. Funds had previously been identified in the 5 year program forecast such that design could be completed during 1979 with two phases of construction over the 1980 and 1981 calendar years. At the same time a project team was established which included Regional E&A as the project manager, the District office and the Band (Appendix 2).

Because design work progressed very quickly and estimates and timing indicated that it would be more cost effective to construct all the proposed facilities in one year, tenders were called to this effect. The low bid received (which was awarded) after negotiation of one item, was in the amount of \$938,699.00 which compared favourably with the "A" level estimate of \$1,068,000.00 and the Treasury Board Project Approval "C" level estimate of January 18, 1980 of \$1,117,900.00 which included design, construction, contract supervision and contingency. Public Tenders closed on May 14 with construction award on July 11 and construction commenced on July 21. Initially work proceeded smoothly, however the presence of unexpected trench rock, and above average fall rainfall during the lagoon construction caused the project to be carried over into the 1981 calendar year. The final contract price due to the rock extras was \$999,742 and the final certificate of completion was issued on June 24, 1981.

While the collection system and lift station are functioning well, a leakage problem developed in the treatment cell. Sewage has been diverted to the storage cell and water was pumped to fill this cell to an operating depth of 5 feet. Due to the low sewage flows and high rate of evaporation the depth reduced from 5 feet to 3 feet. Work will be undertaken in 1983/84 to correct the leakage problem (TEC \$40,000).

3.0 EVALUATION OF PROJECT

3.1 Attainment of Overall Project Objectives

Due to periodic outbreaks of illness as a result of the lack of adequate sanitation facilities, it was decided by the Region in consultation with the band that a sewage collection and treatment facility with individual building connections was the solution. Specifically the project entailed a gravity sewage collection system, sewage lift station, forcemain and a two cell lagoon system to serve 55 existing houses, a kindergarten and provision for future extension of services to a 30 lot subdivision.

Cost and construction scheduling called for design in 1979 with construction phased over a two year period of 1980 and 1981. All design was completed in 1979 and the bulk of construction took place during 1980 with carryover of some work into 1981.

Although design included the 30 lot subdivision, the original concept (and T.B. project approval) was to construct the facilities such that they would be extended into the subdivision at a future date with relative ease. The cost of

the subdivision position was less than 10% of the project cost. With the updating of estimates the region felt it could service the subdivision if the tenders received were low enough. Tenders were called accordingly to include the option of doing the subdivision or not doing it. Tenders received indicated that the subdivision could be serviced with the funds available and it was felt to be more cost effective to do all the work rather than piece-meal at a later date. Treasury Board Circular 1978-46 allowed such minor justifiable changes to scope at that time.

All of the works were satisfactorily completed with the exception of two short streets "L" and "N" in the 30 lot subdivision. The reason for not completing these two streets was due to contract extras and their use would not be required for several years to come. The decision not to construct these two streets met with the approval of the Stony Creek Band Council.

Since the objective of the project was to provide sewage facilities to correct a serious continuing health problem with a stated time and cost, the evaluation team is satisfied that this objective was met.

3.2 The Effective Use of Available Resources

Discussion

For the purposes of this report resources shall mean physical, financial and human.

In the construction of sewage systems the physical resources that bands can provide are material and equipment. The effective use of available material resources concerns itself with on reserve resources, locally made material and material that can be readily obtained within the province.

No gravel or other material resources existed within the reserve. All other materials required for the project were obtained locally with the exception of the sewage lift equipment which had to be obtained from Vancouver but is a nationally available product for which spare parts can be readily be obtained.

Available human resources comprise those of the band and the Department. During construction as many as twelve people at various times were in full employment as general and semi-skilled labourers, survey helpers and weigh checkers.

The Band maintenance supervisor indicated that the contractor was most co-operative in hiring reserve personnel and anyone who wanted a job could have one. On this particular project Mr. J. Yong was assigned as project manager and Mr. B. Lemke as Deputy project manager (replaced by Mr. V. Knight in August 1980). The staff assigned have many years of combined design and construction experience with Mr. Lemke being a specialist in the pollution control field. Regular meetings were held with the band in proposing a best least-cost solution having a minimum construction time and low O & M costs. All feasible alternatives were studied including an analysis of O&M costs, life-cycle costs and simplicity of operation. Services of other E & A personnel and material such as plans, drawings, and other O.G.D'S were made on a timely basis.

Financial resources are those supplied by the Department in the acquisition of goods, services and materials and the method of obtaining them with regard to time quality is a measure of effectiveness in utilizing the funds available. With regard to this project those goods and services consisted of tendering, contracting and consulting.

In this case consultants were used for geotechnical and feasibility studies, design and construction supervision. In obtaining these services the objective is to satisfy the requirements of competency, cost, timing and availability. The consultants so selected were from the Prince George area, and were selected based on the soundness of their proposals, competency in carrying out similar work; reputation of their firm and at a cost which was deemed acceptable and in accordance with departmental procedures for the selection of consultants.

Construction of the work was undertaken after award of contract by public tender. Tenders were widely advertised and the low tender of Hedges Construction Co. Ltd. of Prince George B.C. was accepted. The low tender was below the "B" level estimate and conformed to the "C" level estimate of the T.B. project approval. Departmental procedures and requirements of the G.C.R. were adhered to throughout the tendering and contract phase. T.B. Project Approval No. 768861 and related estimates attached as Appendix 3.

The evaluation team is of the opinion that the region through their management of design tendering, and construction processes made the best use of available resources.

3.3 Cost and Schedule Control

Discussion

Cost and schedule control was effected through established departmental policies and practices.

The general project authorization form (P.A.) and the subsequent project initiation document (P.I.D.) were updated on a regular basis by use of the more recent project identification and change document (P.I.C.D.). Estimates were updated regularly and the "A" level estimate, along with consultants attestation, was prepared just prior to the call of tenders and clearly indicated that the option of including the subdivision was still available. As well, the region developed a project control schedule showing milestones and achievements. These documents are contained in appendix 4.

All contractual arrangements were properly executed in accordance with departmental policies and any extras were justified and executed in the recommended manner and are recorded with proper signatures on file. All invoices and progress payments were processed promptly with proper certifications under sections 26 and 27 of the F.A.A.

Regular site meetings were held with the consultant and the contractor to discuss, among other things, the need for meeting schedules and dates. Resident contract supervision (by consultant) was provided throughout the course of construction and weekly progress reports were provided. As with the construction contract all invoices were processed promptly under section 27 of the F.A.A. These were substantiated with time.

As was noted earlier in the report streets "L" and "N" of the subdivision could not be completed due to unforeseen rock and boulders. In order to keep costs within approved limits these two streets were deleted to meet the costs of paying for the rock and boulder. Details on the rock and boulders are provided in Part 3.7 Deficiencies and Problems of this report.

3.4 Responsiveness to Users Needs

Discussion

The band is well satisfied with the finished product and are of the opinion that it will be the solution to many of their health problems. It is also a major step forward in

convenience (previously of the 55 existing houses, 43 had pit privies) and is a facility in which the band takes pride.

In discussions with Mr. D. Liscum, Band Maintenance Supervisor, who was acting on behalf of the Band manager, there were some initial operating problems with the sewage lift pumps. These have now been rectified and normal operating costs are running at about \$40.00 per month exclusive of salaries. The only concern noted by the band was that the sewage lift station should have included a housing for ease of maintenance during winter weather. For this type of installation, which is entirely below surface with the exception of the control panel, a covered structure is generally not required and this is not considered a design fault. The region however is going to allocate funds for a small structure.

The evaluation team is of the opinion that both users and clients are satisfied with the project in terms of the stated objectives.

3.5 Quality of Workmanship

Discussion

In comparing the construction drawings to the "as constructed" drawings the work was completed as designed with the exception of the sewage lagoon which will be discussed under section (g) of the report.

A review of project site file reports indicates that the resident supervisor assured that specifications were adhered to and this was confirmed by regular site visits of the project manager and deputy project manager. The consultant resident supervisor and the project manager indicated that the contractor has a reputation for quality work and displayed it on this project.

Start up tests were satisfactorily completed for mechanical equipment and an exfiltration test was also satisfactorily completed after sealing of some problem manholes.

Infiltration tests were not conducted as the soil is of a permeable nature with a low water table and at completion of the sewage collection system no liquid was visually evident in the pipe.

Because of winter conditions it was difficult to assess the contractor's clean up of work and the quality of workmanship on the lagoon. While the evaluation team could only accept that this was done satisfactorily, as there were no complaints on the part of the band or the project manager, the evaluation team would have preferred to review the completed work during the summer months especially to note any effects of adverse lagoon performance.

The evaluation team however is of the opinion that the quality of workmanship is acceptable and that the Department received value for the monies spent.

3.6 Adherence to Policies, Standards, Guidelines and Specifications

Adherence to policies standards guidelines and specifications can only be considered against those documents which were in effect at the time the project was commenced or could be applicable if circumstances allowed during the course of construction. Departmental standards and guidelines as they relate to pollution control were not promulgated to the region during the period of design and construction, although advanced drafts were forwarded to region during 1980.

Earlier in the report it was indicated that there was a slight change in the scope of work by including the 30 lot subdivision. T.B. circular 1978-46 which was in effect at the time project approval was being sought allowed for changes in scope. While risk was not identified - specifically in the project approval contingency was and 1978-46 is vague on the distinction between risk and contingency.

During the course of discussions the matter was raised with the region as to why this project was not implemented by P.W.C. in accordance with DRM 10-7/33 since it was Vote 10 and in the order of \$1.0 M. The Director of E&A advised that regional P.W.C. do not wish to undertake municipal services projects and have instructed regional E&A to proceed on their own.

The following functions were carried out in accordance with established policies and guidelines:

- Contracting out for consultants covering at least three proposals, rating board, time, indemnity, terms of payment, terms of reference scope of work, timing etc.

- Construction tenders and execution of work in public advertisement, all contract documentation satisfied, timely progress payments, extras authorized and justified, final completion certificate insurance and bonding requirements etc.

While it has been this departments practice to use G.M.S. wherever possible, only some of these were available in 1979 under Division 16 - Heavy Civil of G.M.S. A review of the project specifications indicated that they are reasonable and generally conform to our DRM 10-7/68 and the G.M.S. The specifications used reflect the standard of practice in British Columbia and the region has had no problem.

One area of concern is in using the Province of British Columbia's effluent quality objectives of a Biochemical Oxygen Demand (B.O.D.₅) of 45 mg/l and Suspended Solids (S.S.) of 60 for discharge to receiving streams. Contained within the terms of reference for the design of the sewage treatment lagoon is the requirement that the effluent quality will conform to the current "Pollution Control Objectives for Municipal Type Waste Discharges in British Columbia". The effluent quality limits provided in this case under permit from the B.C. Pollution Control Board were B.O.D.₅ of

45 mg/l and S.S. of 60 mg/l. These limits exceed the Environment Canada Guidelines for Effluent Quality of B.O.D.₅ of 20 mg/l and S.S. of 25 mg/l as enunciated in 1972 and endorsed by Cabinet as policy. It is also a stated policy of Environment Canada, which is supported by this Department, that we can design to a higher provincial standard for exceptional environmental standards and at a reasonable cost, but never to a lower standard. In this particular instance Environment Canada did not object; however, the region should have either obtained written approval from Environment Canada or sought a decision from the Director General, Technical Services and Contracts.

Because of the low flow and size of the treatment cells, there will probably be no cause for alarm although the region is leaving themselves open to criticism should Environment Canada undertake a national audit as they are proposing to do. It should be noted that Environment Canada and National Health and Welfare were aware of the design criteria and the effluent parameters and gave tacit approval for such. This however does not relieve D.I.A.N.D. of its responsibility in acknowledging and responding to established federal government policy. The consultant terms of reference and B.C. permit are attached as appendix 5.

Another area of concern is that in developing a design for the sewage treatment lagoon the region based their criteria on a design population of 600 in the year 2020 AD (See T.B. Approval 768667) and a per capita consumption of 70 gallons daily. Both of these criteria are in excess of commonly accepted practices both within and out of this Department. While per capita consumption of 40 to 60 gallons per day was not categorically stated in DRM 10-7/71 until 1981, it has been the experience of this Department that reserves of this nature (mostly housing with very little commercial or institutional facilities) only require 40 to 50 gallons per person per day. Additionally, to design for the year 2020 is inappropriate and a design of 10 years with provision for 20 years would be more acceptable. The effect of this over conservative approach to design is that the lagoon treatment system will not function for the purposes for which it was designed and more monies were invested in the project than were really required. Further the band will have to expend funds to maintain liquid levels at operating depths to avoid possible damage from severe winter temperatures dessication and cracking of the clay liner should it be overly exposed.

Finding 1

It was found that the region did not consider Environment Canada effluent quality standards, (and D.I.A.N.D.s) as a stated objective of pollution control facilities.

Recommendation 1

It is recommended that the region review and refer to DRM 10-7/68 Effluent Quality Standards in future designs and consultants terms of reference for the design of sewage treatment facilities.

Finding 2

It was found that the regions design criteria for the sewage lagoons were excessive and over conservative resulting in a facility that is oversized and will require additional O&M funds to maintain proper liquid levels.

Recommendation 2

It is recommended that the region re-evaluate their design criteria so that economies of design will result in cost

savings and that the finished product will provide an acceptable level of treatment.

3.7 Deficiencies and Problems

The deficiencies and problems which arose during this project were noted as follows:

(i) Sewage Lift Station

Shortly after start-up the sewage lift station experienced a continuous fouling of the pumps resulting in one of the pump motors burning out. This was due to cloth and plastic articles being discharged from connected houses and some construction debris which had made its way into the collection system. The Band Maintenance Supervisor installed a bar screen which corrected the problem however the design should have either included a grinder pump or a bar screen. The region indicated that a grinder pump would require 3-phase power which is not available on the reserve but acknowledge that some form of pump protection should have been afforded.

The region during discussion of this matter indicated that on design of future sewage lift stations pump protection will be provided.

- (ii) During the course of construction unanticipated ground conditions in the form of rock and large boulders were encountered even though thorough geotechnical investigations did not reveal a problem. This resulted in extra work quantities in trench excavation of the sewers and boulder removal in the lagoon construction.

With regard to the additional trench rock excavation ample geotechnical investigations were undertaken (Hardy report of December 12, 1978 and Hardy report of February 25, 1980). The December 12, 1978 geotechnical investigations were of a generalised nature for pre-design purposes and were used for establishing quantities, costs and potential risks. Many of the 40 testholes were done to a depth of 40 feet and did not indicate that rock was going to be a problem. Rock profiles however are quite often not homogeneous and tend to undulate. It must be concluded that sufficient geotechnical investigation was undertaken and that there was no reason to suspect that rock would be a problem. Unfortunately the presence of this unforeseen rock resulted in an extra of \$92,000.00 to the contract.

In the case of large boulder excavation geotechnical investigations of the lagoons involved six test pits by backhoe to a depth of 16 feet. For lagoons of this size 6 test pits are considered more than adequate especially when done by backhoe. No boulders were encountered during excavation of the testpits. Test pits were not done on the southern third of the storage cell and this unfortunately was the area where large boulders were encountered. In reviewing the layout plan for the testpits we feel that adequate coverage was given and, further, when testpits are being undertaken it is not normal to continue doing further testing if nothing abnormal has been encountered and past experience has indicated the soil profile to be of a uniform nature. This additional work of large boulder excavation resulted in a contract extra of \$24,000.00.

Rock was also encountered in the southern section of the treatment cell which necessitated a design change. This caused the cell to be reduced in area as no rock removal was undertaken. The design change is not considered to be detrimental.

Due to the abnormally high rainfall during the autumn of 1980 not all of the bottom of the treatment cell around the inlet structure could be properly compacted and scarified and this became a deficiency item carried over to 1981. During the spring of 1981 the contractor completed this work as per the contract specifications and a final certificate of completion was issued. In the summer the contractor carried out additional scarification and recompaction and had almost completed this work when the Band began discharging sewage into the treatment cell thus inhibiting the contractors work. At the same time as this occurred a sit-in of the regional office was taking place and neither the Project Manager nor the Deputy Project Manager could be reached for a decision to halt the work. The contractor was no longer liable for the work.

As filling of the pond continued, it became apparent that there was a high rate of seepage due in some part to bottom dessication but mostly attributable to the area around the inlet structure. To temporarily correct this problem, a bypass was installed to the storage cell. The region plans to correct the seepage problem in the treatment cell at an estimated cost of \$40,000.00 during 1983/84. All related engineering reports and studies are attached as Appendix 6.

4.0 GENERAL REMARKS

4.1 Contract Approval Process

Discussion

As was noted in the Project History tenders closed on May 14, 1980 and the region was telexed on July 11 of Treasury Board approval some 58 days later. The documentation was sent to TS & C contracts division on May 20 and was received on May 29. On that particular day (May 29), the documentation was reviewed and the contract submission prepared recommending approval of the low bidder was sent to Resource Planning and Analysis. An examination of both the regions and headquarter's files maps the chronology of events except that there is no indication of what events occurred after May 29, 1980 as the headquarter's file A-2945/B1 (same file as the T.B. contract approval submission) contains no information on the project. The only related correspondence is in the form of telexes from Technical Services and contracts to the region one of which indicates that the submission was sent to Treasury Board on July 2. Correspondence related to this subject is attached as Appendix 7.

Since the low bid was acceptable, without anomalies, was below the "B" level estimate and was slightly below T.B. project approval 768861 of November 14, 1979 the region cannot understand why contract approval took so long. The evaluation team agrees, especially since all technical concerns had previously been resolved. It should be noted that the region as a matter of course always exercises their option to extend contract award where T.B. contract approval is required as they have come to expect the full time limit of 60 days.

The effect of this delayed approval in conjunction with an unusually high rainfall in late autumn almost certainly necessitated the project to be carried over to 1981. Also, because of this high rainfall, proper compaction techniques could not be applied to the high moisture content/plastic nature of the lagoon floor soils such that a leak developed. While it cannot be conclusively stated that the project would have been completed before the 1980 calendar year if the foregoing problems had not arisen, it is reasonable to assume that only minor clean up work would have remained had quicker approval been provided.

Finding

It was found that for this Vote 10 project and others discussed with the region, there appears to be an unreasonable delay at Headquarters in processing tenders for award when all Departmental requirements have been satisfied.

Recommendation

It is recommended that in order to improve the delivery of projects headquarters re-examine the approval process in expediting contract approval submissions, especially as it relates to Resource Planning and Analysis to avoid timely construction delays and maintain credibility with the construction industry and regional officials.

4.2 Completion Report

Discussion

As part of the project management process and as one of the tasks of the project team (see project team establishment letter of July 24, 1979 to E & A director attached as Appendix 2) the production of a project completion report was required.

Finding

This project completion report was well done in relation to its format, content and quality of presentation. The region is to be commended for its excellence. This completion report is attached as Appendix 8.

Recommendation

It is recommended that TS & C review this completion report in detail and consider it for distribution to other regions as a model for completion reports and the basis for capital project evaluation reports within the region.