THE CLOVER BAR LANDFILL
A STATE OF THE ART LANDFILL RECLAMATION PROCESS

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INTRODUCTION

The Clover Bar Landfill, located in northeast Edmonton, is situated along the North Saskatchewan River. The site was opened to receive solid waste in the 1970's. The first phases were closed and capped in the early 1980's. In keeping with standards of the day, the area was covered with a shallow layer of topsoil, a mixture of agronomic grasses, and a few ornamental trees for beautification. The result was visually unappealing and ecologically unstable. The site required large inputs of resources for maintenance.

A revised, long-term revegetation plan for the Clover Bar Landfill Site was developed by Landscape Architect, Don Barron, in collaboration with Agrologist, Nolan Turner. A comprehensive site evaluation highlighted the need for mitigation of several site conditions that could discourage or limit plant growth and development. These included: toxic substrata materials, an impenetrable clay cap, shallow topsoils, soil component deficiencies and/or excesses, poor moisture conditions due to slope design and persistent high winds, and an extensive agricultural weed problem from on-site and from numerous adjacent sites. The reclamation plan outlined a series of unique methods to mitigate these conditions. This site was also recognized as a major movement corridor and safe refuge (from man and his activities) for wildlife from nearby natural areas.

DESIGN

Maintaining ecological and aesthetic integrity of the North Saskatchewan River Valley Park System was a guiding factor in the design process for the Clover Bar Landfill. The design was based on accelerating natural succession by establishing key plant species and recommended the establishment of numerous, strategically placed 'nuclei beds' planted with a heterogeneous mix of native trees, shrubs, and herbaceous perennials.

Phase 1 was designed as a trial to supplement the limited information available regarding the most efficient use of native species and the best production and planting methods. A short-term maintenance program was designed to encourage establishment and development of a sustainable, self-perpetuating, native 'Urban Forest' ecosystem

Principles of recycling and reuse were incorporated into the reclamation plan. Materials recommended for use on-site (topsoil, compost, sewage sludge, and mulch) were recycled from other projects and programs. Plant materials were collected in areas slated for development and

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irrigation water was obtained from the existing ground water diversion system on the periphery of the site.

PLANT MATERIALS

Approximately 25 species of woody plants were placed in Phase 1 trial beds. Trees and shrubs were produced by one of three methods. The first was to salvage small, mature plants from areas that would likely be disturbed. Plants were either moved directly to planting beds or maintained in the nursery (in pots) for three months where they were fertilized to encourage significant root development. The second method was by various cuttings. Pole and hardwood cuttings were placed directly into planting beds in spring whereas softwood cuttings were rooted in the nursery prior to being set out. The third propagation method was by seed which were sown directly in planting beds on site or sown in styroblock containers and maintained in the greenhouse until sufficient root and top growth developed. Herbaceous perennials (representing 15 species) were grown in styroblock containers in the greenhouse from seeds or cuttings.

To ensure adaptability of plants to local conditions, indigenous plants used for planting at Clover Bar Landfill were collected within the immediate area (a radius of 50 km).

CONSTRUCTION, PLANTING, AND MAINTENANCE

Construction of Phase 1 beds was completed in 1993. Phases 2 and 3a were completed in 1994 and 1995 respectively. Bed areas were mowed and existing vegetation and substrates were removed. Beds were refilled to a depth of approximately 30 cm with topsoil combined with sewage sludge and compost. Planting of Phase 1 began in late summer, 1993 and completed in 1995. Phases 2 and 3a were planted in 1995.

Mulch was placed in each area soon after planting. Plants were watered immediately and continued to be irrigated as necessary. Large weed populations had developed on the site (and on adjacent lands) prior to beginning the reclamation process and an intensive weed control program began in June 1994. Planting beds will be weeded for up to three years as required to provide a competition-free environment for native plants to establish well developed root systems. Control measures for other pests and diseases were only taken if survival and establishment of the native plants was likely to be compromised.

MONITORING

Wild Rose Consulting, Inc. was retained in 1994 to design and implement a vegetation monitoring system. The objectives of the monitoring system were to determine if the plant materials and the methods used to produce, install, and maintain plant materials would provide the desired results (i.e. a dense cover of a variety of plant species of diverse age). Two types of data were collected to determine the success of the planting beds. The first was to measure and assess the success of each group of species and planting material type. Assessment parameters included emergence (for seeds), survival, and vigour of plants. The second type of data recorded were observations of natural recruitment or natural invasion by indigenous species from surrounding and adjacent native areas. Data were collected in 1994, 1995, and 1996 and analysed annually. Results are used to re-evaluate designs on an on-going basis.

RESULTS

Salvaged plant material of most species performed well; they exhibited high survival rates. The advantage of this method is that resulting plants were vigourous and several were spreading (some at rates up to 1.5 m per year). Styroblock material generally survived well in the first year, but many of these plants but were not necessarily vigourous. Species raised in styroblock containers were small and take several years to provide the desired vegetation cover; particularly with species that do not spread by root shoots or rhizomes. Plants grown from cuttings showed variable results.

Several species established well from seeds sown directly in the planting beds but seeding results were variable. Seedlings take several years to develop into large plants that provide a dense cover. During this time weeds must be kept to a minimum and maintenance costs can escalate. Seeding could be particularly effective if used in combination with other methods (e.g. seeding under sparsely planted mature material).

Numerous native plants became established in planting beds by seed spread from existing native stands adjacent to the site. This was especially prevalent in the lowest beds on the north aspect where the beds were only metres from existing native stands along the river. Some of these trees and shrubs that established in 1994 had grown to a height of over 3 metres by 1996. Approximately 20 herbaceous species also became established in various beds.

CONCLUSIONS

Approximately 50,000 plants were installed in planting beds in the first three phases of the project; over twice this many have emerged from root sprouts, from seeds produced by the initial plant material, or have migrated from surrounding native plant communities. Phases 2 and 3a planting designs were revised to accommodate the higher than expected emergence and survival rates and plant vigour observed in Phase 1. The thriving plant material of the early phases will provide much of the green stock required for the balance of the project (Phases 3b, 4, and 5). Continued monitoring of plant establishment and growth (and more particularly the development of integrated plant communities) will provide a significant amount of information that can be applied to future phases to further reduce costs and increase the potential for success.

The success of plantings in Phase 1 has been extraordinary. In spite of very difficult site conditions and numerous constraints, heterogeneous, dense thickets have developed. These 'Urban Forests' are continuing to evolve and become more complex as additional plant species migrate into these areas and as various wildlife species (deer, rabbit, fox, coyote, and many songbirds) begin to utilize them for food and cover.

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An Ecosystem Perspective

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