INDUSTRIAL LAND RECLAMATION: PARTNERSHIPS BETWEEN INDUSTRY, GOVERNMENT AND ACADEMIA – THE ROLE OF GRADUATE STUDENTS OF LANDSCAPE ARCHITECTURE

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ABSTRACT

The reclamation of industrial lands is one of the great environmental challenges of the new millennium, as society addresses the legacy of its heavy industrial past. This legacy is the result of many factors, including the incremental accumulation of industrial wastes over time, the abandonment of now redundant industrial facilities, and the down-sizing and conversion of on-going industrial activities and industrial sites. Reclamation of industrial lands requires the skills of many disciplines, and the participation of many players. Since 1992, the graduate students of the School of Landscape Architecture at the University of Guelph have been involved annually in course work that focuses on co-operative landscape restoration, rehabilitation and reclamation efforts for a wide variety of sites, including a range of very challenging industrial sites. This paper presents a summary of the experience and contributions that landscape architecture students can provide in advancing efforts to effect industrial reclamation on various industrial sites in the Hamilton Harbour and Niagara Falls areas. The projects represent a diverse range of collaborations between private industry, several types of public agencies, and universities. The conclusions drawn from these experiences are that the benefits and advantages of the participation of landscape architecture students are many, unique, valued and valuable, including, among others, providing practical project experience for the students, promotional value for industry and agencies, and tangible solutions for site restoration, which lead toward on-site implementation and environmental improvement.

Introduction

As the clock winds down on the 20th century, we look ahead to the promise and possibility of a future in which we have both the means and motivation to face the great environmental and social challenges that are before us. As we approach this imagined temporal divide, we may be tempted to sever ourselves from the past, and cast our gaze forward into an optimistic future. The irony, though, is that to look forward we must first look backwards, for it is the past that has left the legacy of challenges that must be met in the new millennium. Nowhere is this more self-evident than when one regards the enormous environmental legacy that we have inherited from our heavy industrial past.

This paper recounts the experience of students of landscape architecture who are making a contribution to address, or perhaps more accurately to redress, some of this legacy. For more than five years, graduate students in the School of Landscape Architecture at the University of Guelph have been making their contributions to the team effort required for industrial land reclamation, as part of course work offered in a master's program. Students have been involved annually in projects that focus on co-operative landscape restoration, rehabilitation and reclamation efforts for a wide variety of sites, including a wide range of industrial sites. This has been an opportunity to explore the role that landscape architecture may contribute to industrial reclamation efforts.

The role of the landscape architecture students will be described by first summarizing the general context of their course work, and then discussing a case study of an on-going industrial land reclamation project for CYTEC Canada's Welland Plant in Niagara Falls, Ontario. In this project, the contributions of landscape architecture students, amongst others, are yielding exciting and very promising results in a collaborative project that brings together industry and academia, working together for environmental improvement. This will be followed by discussion of the benefits of such projects and what has been learned along the way.

Reclamation of Industrial Lands: The Legacy

Centuries of industrialization have left their mark forcefully and indelibly on the global landscape. Our cultures may well have evolved into the post-industrial era, but we still live cheek to jowl with what we have left behind from industrialization This leftover baggage is found in vast and obvious evidence in the mountainous colliery wastes of northern England, the gargantuan slag heaps of Germany's Ruhr Valley, the miles of abandoned steel mills along rivers in the great American Rust Belt, the petro-chemical sludge in the Detroit River, or the incidence of cancer in the Russian Urals. But the relicts are found in smaller and more subtle pieces, too – a toxic fire in a Hamilton, Ontario recycling depot, an abandoned foundry in Guelph, Ontario with soils too toxic for anyone to want to buy the site, post-war radioactive soils in Stouffville, Ontario, leachates from long-decommissioned domestic landfills. We do not have to look far to face our legacy.

We have inherited this legacy in many ways. Most obvious, perhaps, is the simple accumulation of waste by-products of all our many resource extraction and industrial production processes, and energy production and transportation technologies. What we do not want, we cast aside, like the tonnes of ore from which we extract grams of gold. In getting what we want, we make many things that we do not want, like sulphurous smoke from incineration of coal for power. Our legacy is stored in air, water, and soil, like heavy metals settling in harbour sediments or bio-accumulating up the food chain. When demand drops or technology changes, the facilities that become redundant are left abandoned on the landscape – often as problems to solve with no one willing to take the responsibility to solve them. When the economy swings, a product line shifts, production is moved to where the labour is cheaper, or a down-sizing is implemented – the plant closes, the workers leave, and the gates swing closed. Sites are abandoned, ruins remain. A facility -- once an asset – now becomes a liability.

Reclamation of Industrial Lands: The Roles

It is unnecessary, for the readers of this paper, to detail any further the nature of the legacy we have inherited. We are united by a common desire and motivation to address this legacy and do our level best to restore, reclaim, and rehabilitate the industrial landscape to a condition of ecological integrity, function, and health. Undoubtedly, all the readers of this paper are also very well aware that this is a daunting task that takes the skills of many disciplines and the participation of many players. Whether ecologist or engineer, hydrologist or terrestrial biologist, planner or politician, CEO or community activist, there are important niches to fill in the co-operative task of industrial land reclamation. No one discipline has all the skills that are necessary to bring to bear on the problems. The challenges are too great. The conditions are too complex.

One group of players includes landscape architects. As planners, designers, and makers of landscapes, they have a particular tool box of skills that can be applied to the problems of industrial land reclamation. These skills include the ability to analyse site conditions, propose certain kinds of physical design solutions, and manage their implementation. They are particularly adept at giving physical form to ideas.

The Role Of Landscape Architecture Students

Reclamation of Industrial Lands: The Academic Context

The Guelph School of Landscape Architecture is a professional school which offers instruction in landscape architecture at both the undergraduate and graduate levels. The work related in this paper has occurred in or partially as a result of, or with the participation of, a graduate level course in the second year of the three year Master of Landscape Architecture (MLA) program. The course is entitled "Plants and the Environment" and focuses on a combination of planting design and applied ecology, and always involves intensive project work in the design studio in combination with lecture content. The intent of the course, and the entire program for that matter, is to produce professional landscape architects who are informed and aware of the challenges that will face them in the professional world, and to provide them with hands-on experience that will equip them to meet the challenges.

For the last six years, the course has been organized such that the students have undertaken "real" projects for "real" clients in which the role of the students is to provide design and technical services for the community, industry, or government who would not otherwise have the means or the opportunity to acquire landscape architectural services. For the last five years, projects have included numerous industrial reclamation sites, which represent collaboration between the students, their instructors, and a variety of public and industry clients.

The first (non-industrial) restoration project was undertaken in response to a request from The Kleinburg and Area Rate-payers Association, north of Toronto, and involved the conversion of a corn field into a naturalized community forest. Since then the list of clients has included Parks Canada, The Royal Botanical Gardens in Hamilton, the cities of Hamilton and Burlington, the Hamilton Harbour Commission, the Canada Centre ofr Inland Waters, a steel products manufacturer on Hamilton Harbour, Conestoga College in Kitchener, and most recently, the Welland Plant of CYTEC Canada, a chemical manufacturer in the city of Niagara Falls.

These studies represent a diverse sampling of collaboration between academia, government, and industry. A hallmark of each project undertaken to date has been the liaison of the students and their instructors with the client, and often many other players. For the Kleinburg project, the students worked with community members, and organized and presented at public meetings. The Trent-Severn work involved co-ordination with the Parks Canada Regional Office in Cornwall, regional managers of the Trent-Severn Waterway, local lockmasters and maintenance personnel, and the community group the "Friends of the Trent-Severn." Much of the work in the Hamilton Harbour area was facilitated over two years between the many clients by John Hall, co-ordinator of the Hamilton Harbour Fish and Wildlife Restoration Project. The work at Conestoga College involved the College administration as well as the plant operations staff. On-going work at CYTEC Canada involves a collaboration of CYTEC personnel, with faculty from both the University of Guelph and the University of Waterloo.

The range of projects has also been very diverse. Work for Parks Canada involved the preparation of naturalization schemes for four lockstation sites on the Trent-Severn Waterway, each of which was in a different ecological context. Some of the portions of these sites represent what might be thought of as "old" industrial sites, comprised of 90 year-old piles of rock wastes that were the detritus of canal building, and sites that were former 19th century mill or manufacturing centres. Sites in the Hamilton Harbour area ranged from a restoration of oak savanna and natural shoreline to areas of toxic industrial fill. Even the relatively benign campus of Conestoga College featured a pond that is the relict of a former gravel pit operation. The work at CYTEC focuses on large brownfield demolition site, occupying a large portion of an otherwise active chemical plant

Course Organization

The course occurs in the fall semester of the second year, and lasts for one semester. Class size in is the range of 12-15 students, whose backgrounds are very diverse. Their undergraduate education typically includes a balance of degrees from the liberal arts, the environmental sciences, and planning, with a smattering of fine arts, business, education, undergraduate landscape architecture and other degrees, including the occasional PhD. The students are cultural diverse as well, and have included students from all parts of Canada, the United States, mainland China, Taiwan, and Russia. The students are typically older, the age ranging from the mid 20s to the late 50s, although the majority are in their mid to late 20s, with a balance of males and females. Many have extensive work experience of many types, including technical, educational, professional and business occupations.

The studio portion of the course is organized very much like a consulting office. Students are organized into groups to accomplish the tasks that need to be done, while the primary instructor, Larry Harder, acts as an advisor for the essentially self-directed teams. The instructor searches out and sets up the project, initiates the initial client contact, tends to the essential administration and organization that is required, and then sets up the client /consultant relationship between the client and the students.

The criteria for project selection are that the project must emphasize the restoration or rehabilitation of "natural systems" with an emphasis on plants and habitat creation (no major structures or civil engineering, for example), it must be large enough to be able to consider the problem at a variety of scales, it must be diverse enough to offer a variety of challenges and potential solutions, and it must have a community service or environmental improvement objective.

There must also be a willing and participatory client. In securing projects, it has been the practise to ask the client for commitment of financial support, as a measure of commitment to the process. The funding, which has varied in the range of $2000 to $8,500 per semester, is used to offset students' out-of-pocket expenses, travel and accommodation costs, and production costs for the deliverables given to the client, as well as copies for school records. Clients are asked, too, to provide a designated liaison for the project, to offer whatever technical assistance or background data that may be available, and to be present at and provide feedback to the students at presentations of the work

There are high expectations of the students as well. It helps that they are usually highly motivated by the difficult problems they are asked to address. They are expected to treat the project seriously and approach their work with a high level of professionalism. They appreciate and respond to the financial support of the client, and are expected to manage their expenses in a fiscally responsible manner (with oversight by their instructor). They are also expected to deal with their client according to all the accepted rules of client contact, including client confidentiality. They are expected to be organized and thorough. In short, they are expected to treat the project as a real consulting job.

Projects typically involve three phases, each of which is characterized by deliverables that are provided to the client(s).

The first phase is a background phase, in which the students are required to acquire and analyse background data, to determine or clarify the project terms of reference, to investigate the site, to establish client rapport, and to report their findings. This is typically accomplished as a class-wide effort, usually kicked off by an initial client meeting and site visit. This phase culminates in a formal, professionally organized background report which is provided to the client.

The second phase is a "masterplanning phase" which is usually done in groups of three or four. The objective of this phase is to propose a physical design solution for the site(s) with information that suggests how it might be implemented. The product of this phase is a set of alternative physical plans for the restoration, rehabilitation, or reclamation of an entire site, typically at scales between 1:1000 and 1:5000. Sometimes this means three or for different masterplans for one site, as in the case of Conestoga College and CYTEC Canada. Other times this may mean plans for a diversity of sites in the same area, as has been the case for our work for the Trent-Severn and Hamilton Harbour. The deliverables for this phase include physical plans, as well as written design briefs and a management plan. This phase is usually completed by a formal presentation to the client, with invited guests who may be professionals, community members, corporate executives, or any combination of others.

The last phase is a more detailed design phase. Students individually select a detailed portion of the masterplann site to develop into more detail, at a variety of scales between 1:1000 and 1:200. Students are allowed the option of doing a detailed physical plan or a detailed management plan. Most choose to do a detailed physical plan. The tangible products of this final phase are 12-16 detailed layout and conceptual planting plans/management plans for portions of the overall site.

The client is given full-size black-and-white prints of all the plan drawings, copies of any reports, and usually a set of colour slides. Colour slides have proven to be an economical way to provide the client with a portable, useable, and adaptable record of the work, while the students can then retain the original colour drawings for their professional portfolios. The conclusions of the last phase depend on circumstances, and also may end in another presentation, or sometimes in an open house or exhibition of drawings, preferably at the client's location. In any case, client representatives and most often also other invited participants are asked to view and comment on the student work.

Range of Sites: Range of Challenges

The range of sites that the students have been asked to address have been very wide, the challenges very great, and many of the solutions very innovative. Some of the restoration challenges are very gentle and the sites almost pristine. One proposal for restoration in the Hamilton Harbour area addressed the restoration of oak savanna in a virtually undisturbed site adjacent to Cootes Paradise (the site of a major on-going wetland restoration managed by the Royal Botanical Gardens) in which the rehabilitation issues dealt with biodiversity the subtleties of ecosystem change over time, the effects of the long-term suppression of fire, the selective removal of competitive species, and recommended spacing of forest thinning to achieve the necessary light intensities for savanna species. At the same time, at the other end of the same Hamilton Harbour, another group was given the challenge of determining what to do, in terms of shoreline and backshore habitat creation, with a shoreline property which was mostly an asphalt parking lot covering a site comprised of gravel fill over top a glacial beach bar. The site was located underneath the Burlington Skyway Bridge of the Queen Elizabeth Way expressway, at the entrance to the Burlington Ship Canal (the entrance to Hamilton Harbour), in which the main shoreline dynamic was the irregular two metre displacement of water at the shoreline edge as large ships passed through the canal.

Many sites have involved shoreline or aquatic conditions. Students have contributed to the on-going restoration efforts for Cootes Paradise, which is one of the largest freshwater wetland restorations ever undertaken in North America. One of many challenges here is how to undertake a wetland restoration in which the hydrological cycles are opposite to natural wetland cycles: Cootes Paradise is linked to Lake Ontario, the water level of which is maintained for navigation and power generation at Cornwall at a level which is highest in late summer and fall, which is opposite to the late summer and fall draw-down which normally occurs in temperate wetlands. Another

Hamilton Harbour site concerned shoreline naturalization ideas for Hamilton's West Harbourfront area, currently occupied by rail lines and rail yards on fill. One of the more challenging sites was the linkage between Hamilton Harbour and Cootes Paradise, through the historic Desjardins Canal, which runs underneath a main CNR rail line, a GO Train commuter rail line, York Boulevard (a major arterial road), Highway 403 (an expressway), and a major transmission line – all in a couple of hundred metres.

Project sites have also included stream restorations, bank stabilizations, and fish and wildlife habitat recreations. All of these projects have their challenges, which face the students with hard decisions. The realization came to one group working in the Windermere Basin of Hamilton Harbour, an area with heavily polluted bottom sediments, that by installing a biologically diverse wetland re-creation, they would be inviting waterfowl to die, by providing them with a diet of heavy metals, phenols, and other contaminants taken up by the plants. It was discovered on the actively used site of the steel product manufacturer that the "soils" consisted of 2 metres of highly alkaline blast furnace slag, on top 2 metres of domestic landfill, which overlay an indeterminate depth of organic mucks, the deeply buried remnant of the pre-development shoreline marshes of the site. Even at the relatively benign and apparently pastoral site of Conestoga College, the soil conditions were found to consist of a thin layer of imported topsoil spread over a post-extraction substrate of almost pure gravel, with drainage too rapid and fertility too low for many woody plant species.

The challenges faced by the students have not been limited to the physical qualities of the sites. Some of the work in Hamilton Harbour done for the city proposed plans for property actually in disputed jurisdiction with the Hamilton Harbour Commissioners. Harbour work that involved fish habitat structures, was criticized by the boating community for reducing even further the navigable recreational area of the harbour. It came as a surprise to many students that any shoreline rehabilitation activities in Hamilton Harbour came under the terms of the Federal Navigation Act, including the now non-navigable Cootes Paradise. For the steel products manufacturer's site, all major meetings and presentations had to be attended by representatives of both management and the union. One group dealing with a naturalization of a Trent-Severn lockstation had to wrestle with the very real problem of a site maintenance supervisor who had been on the job for nearly forty years, whose image of proper site management did not correspond with the students' (or Parks Canada's) objectives for naturalization. The students' pragmatic proposal for a solution: wait until he retires.

Response of Clients

The client collaborators have almost always been overwhelmed by the results of the students' efforts in the Plants and Environment course. They are briefed at the outset of the process on what to expect, in terms of the deliverables, but usually do not expect the depth or the quality of the product that they receive. They are particularly impressed at the outset by the students' graphic products, in the form of plans, sketches, sections, and report graphics, which are particular skills that landscape architects bring to communication. They are also impressed by the students' verbal presentation skills.

There is always debate about the details of the solutions themselves, but most of the time the criticism is not negative, but more often than not is simply informed by the clients' greater familiarity with the context and the difficulties, which range from the physical to the financial, political and administrative.

Perhaps the most common general reaction is that the client is given the opportunity to see their problem or their site in ways that they had not necessarily previously considered. They begin to see the possibilities that have been given form by the students. The following case study gives some indication of what a motivated client is prepared

to do with the possibilities. In this case, landscape architecture students entered into a process that had already been initiated.

CYTEC Canada Welland Plant: A Case Study

Background to the CYTEC Study

In the fall of 1996 representatives from the Universities of Waterloo and Guelph were invited to the Canadian Corporate Headquarters of CYTEC Canada, a chemical producer, at their Welland Plant in Niagara Falls, Ontario to discuss the potential for restoration, rehabilitation and reclamation of portions of the site which are no longer in active industrial use. The purpose of the project was to develop strategies and plans for landscape, aesthetic, and environmental improvements for the Welland Plant property, which in total is in the order of 405 hectares (1000 acres), comprised of an active chemical production facility, administrative buildings, active and decommissioned settling ponds, and a large demolition area. The operating plant currently consists of an administration cluster and a production plant which together, though physically separated, occupy only a very small portion of the site.

The circumstances that initiated this meeting had been developing over a number of years as CYTEC found itself evolving its product line and in response to that, its physical plant as well. The facility had begun in the war years as an ammunition factory, had converted to fertilizer production in the post-war period, and is currently producing phosphine gases and phosphine products. The result of this corporate evolution was a large inventory of decommissioned buildings and infrastructure systems. Demolition of these facilities began in the 1980s such that by the end of the 90s an area equivalent in size to perhaps twelve city blocks had been razed to the ground. It was presumed that many physical and chemical remnants of all of these enterprises were present to some degree on the property when the universities first evaluated the site back in 1996.

The Details of the Collaboration

Since removal of buildings and infrastructure was a major component of the facility's evolution in the 1990s, a great opportunity was provided for an alternative land use -- particularly one involving a landscape component that responded to industrial conditions yet linked to existing plant communities and ecosystems both on and off site. Both institutions immediately recognized the tremendous opportunity the site held for industrial rehabilitation and restoration, and the value of housing the project within a multi-disciplinary academic setting. Both institutions were aware that the skills and knowledge that would be required for this task demanded their collaboration.

Initiated by the client, and based on a desire to enhance their corporate headquarters not only aesthetically, but ecologically, this undertaking is a substantial commitment.

While members of the chemical industry are often reluctant to open their doors to potential outside scrutiny, in this case, both universities were invited to investigate the site's potential prior to initiating any physical rehabilitation work. The work has been co-ordinated from the CYTEC side by employee Brain Schram, with the participation of a number of others including Dave Cole, George Slayney, Doug Roy, and Plant Manager Tony Mueller. Since the client has been receptive to the advice of the Project Team and has been open to experimentation, the potential for the project to be an evolving site for current restoration research is immense.

Through 1997 the site was evaluated in three distinct phases. The First Phase was undertaken by planning students at the University of Waterloo School of Urban and Regional Planning, directed by Roger Suffling. In Phase 2 students enrolled a Waterloo Environmental Studies field course, and instructed by Larry Lamb, generated preliminary base data on soils, water, vegetation, and wildlife before handing off the project in the fall of 1997 for Phase 3 to design students at the Guelph School of Landscape Architecture, who were instructed by Larry Harder and Fiona Rintoul. Greg Michelenko and Steve Murphy from Waterloo also participated in various capacities in the first two phases. A separate visual analysis had also been completed as a summer project by Fiona Rintoul, with the assistance of landscape architecture student John Lewis.

The net result of this year-long investigation was the generation of several masterplan strategies which pointed to the need for a much more rigorous and detailed design and implementation phase, now underway through 1998. A commitment was made that 1998 was to be the first year of a five year collaborative involvement between CTYEC and the two universities, involving at least three distinct faculties, with the additional involvement as required of professional consultants and contractors.

The On-going Work

To initiate the implementation phase, the Guelph and Waterloo professionals who had been involved in the previous phase of the study met with CYTEC personnel and after careful re-examination of the masterplans produced by the landscape architecture students in the Fall of 1997, came up with a working concept plan, which was to be elaborated as the implementation proceeded.

To get the project into the ground, a summer student employment project was created. Four students were hired, including Denise Hands, one of the graduate students from Guelph who had worked on the project in Fall of 1997, Heather Whitehouse, an undergraduate biology student from Waterloo, and two labourers. The students were hired as employees of CYTEC, but for the purposes of the work to be done for the project, were supervised by their university instructors, who were in turn hired as private consultants to oversee the project (within the framework of accepted administrative arrangements with their institutions). As well, another Waterloo student, Jason Whitfield, concurrently undertook soil studies on site as an undergraduate thesis topic. This group constituted the on-site project team. Denise Hands was given responsibility of on-site project co-ordination.

While 1997 involved very selective visits to the site, in the summer of 1998 students, faculty, and CYTEC employees were working together on a daily basis, generating more detailed base information, mapping physical conditions and modifying the design concept to reflect those findings. At the same time, initial plant community installation was taking place in areas where conditions were most receptive. As this is written, both native prairie and meadow communities had been established, while conditions for forest, carr, wetland, scree, and alvar communities were still being verified. A number of bird nesting boxes and perching poles have been installed. A monitoring program has also been set up to monitor the success of these and other planted areas. An experimental alvar habitat area has been designed for summer construction and fall planting. A node of slough forest has also been designeted for planting in the Fall of 1998 in proximity to the main administration buildings. Several small woody nodes of "scree forest" at the main entrance to the plant and at major intersections were also planned for Fall implementation.

A great deal of time was devoted in the summer of 1998 to searching out, verifying and synthesizing information concerning existing conditions. This work was done primarily by students in a number of disciplines, including landscape architecture, biology, and environmental science. Background research has included a detailed inventory of existing plant communities and associated site conditions, the monitoring of hydrological conditions

such as standing water, level of the water table, and toxicity levels of surface and subsurface water; as well as the monitoring of subsurface conditions such as locations of buried foundations, basements and other demolished structures, remaining infrastructure, soil compaction, toxicity and composition.

All of the above background research is being used to inform the design process as it proceeds and is being amalgamated into the comprehensive masterplan and a proposed overall management plan.. Modifications and additions to the masterplan are being made on an on-going basis as more details are learned about existing conditions, limitations and opportunities.

This work required that students had open access, not only to the site and the conditions found there, but also to corporate reports, base maps and the experiences of current employees.

The Scope of the Project: Some of the Details

CYTEC's long production history involving a range of different chemical processes in various locations around the site, has resulted in a myriad of combinations and subtle gradations in current site conditions. Some of the remnants of industrial production on the site include: surface deposits of cinder and gravel of various depths, soil compaction, as well as varying levels of nitrate, ammonia and phosphate contamination in the soil. Many buildings have been leveled to ground, but their foundations, basements and infrastructure generally remain and have been back-filled with construction debris. Roads and rail lines have been removed. Thus a patchwork of perched water tables and varying soil and drainage conditions has been created. The one aspect of the site that is relatively constant throughout is topography. The main demolition area, which is the focus of work for 1998, is relatively flat with most of the topographic variation occurring at the north and south perimeters where two water courses, Thompson's Creek and Chippawa Creek, respectively, cross the site.

The physical complexity of the site adds complexity to the design process. However it also lends itself to the development and enhancement of a variety of habitat communities. A concerted effort has been made to match appropriate habitat communities with current conditions in order to minimize costly and time-consuming amelioration and increase survival rates. For example, many of the concrete pads which remain on the site will be used to develop pavement alvar communities emulating local limestone alvars on the nearby Niagara Escarpment. There are plans to use piles of concrete rubble from demolished pads as well, in conjunction with the alvars and to create snake habitat. Extensive monitoring of existing plant communities and their associated site conditions is also being conducted on an on-going basis in order to develop models for appropriate post-industrial vegetative communities. Other proposed habitat communities for the Welland site include: open grassland, meadow, prairie, wet meadow, shrub thicket and carr communities, a wetland complex, slough forest, upland Carolinian forest, early successional forest, forest edge and riparian communities. The grassland communities will dominate the central portion of the site where the maintenance of clear views from the administration area to the production area is a priority. In the perimeter areas of the site, taller plantings such as the forest communities will be developed. Slough forest is a dominant community in the undisturbed areas of the surrounding region supporting a number of provincially rare species, and thus will be a priority community for restoration.

Because of the complicated nature of the site, as well as the number and variety of different parties involved, the CYTEC Canada Welland Plant Rehabilitation Project has necessarily been a balancing process from the beginning. Short term goals need to be balanced with long term plans. Likewise, the goals and motivations of the various parties involved need to be in equilibrium. In this instance, for example, design and implementation work is the primary responsibility of Guelph, while data inventory and monitoring are spear-headed by Waterloo, with major logistics, equipment use and so on co-ordinated by CYTEC. The wish to create an immediate effect and

make significant progress must be offset by the very real need to continue gathering further background data in order to make informed decisions. Similarly, what is currently being implemented must be integrated into the structure of the long term management and design goals, without being haphazard or restricting flexibility. From a practical standpoint, the desire to restore the site to its original habitat communities must be tempered by the harsh present realities of the site and its capabilities. Likewise, visual effect must be balanced by cost effectiveness. Survival of plant material must be weighed against reasonable maintenance time and costs, as well as ecological diversity. Some diversity will have to be sacrificed since the present site conditions preclude many species that cannot withstand the harsh environment without high levels of amelioration and care.

The Specific Role of Landscape Architecture Graduate Students

The complexity of the project means that there are a significant number of areas where specific expertise and/or background research is needed. This provides an excellent opportunity for graduate students in landscape architecture to become involved in the project. Because landscape architecture graduate students generally come from a wide variety of educational backgrounds, they have a very broad range of expertise to offer as well as advanced research skills. Thus far in the CYTEC project, landscape architecture graduate students have been involved in the preliminary design phase (developing innovative and comprehensive plans for the overall site); in the research phase (researching specific aspects of the site such as the feasibility and techniques for establishing alvar communities, and/or techniques for ameliorating various site conditions); and in the implementation phase (masterplan design, installation, developing promotional graphic material and evolving detailed planting and management plans for a number of distinct areas of the site). This is all undertaken, of course, under the guidance of their instructors, in their context as academic consultants.

Involving graduate students in the project is an important way for CYTEC to reduce costs and is a very appropriate "grassroots" approach for this type of project. Given the large scale of the site, such a project might be cost-prohibitive otherwise. As a hired summer intern, for example, a graduate student can be on site on a daily basis easing the collection of data and allowing for regular monitoring. Site presence also increases the profile of the project amongst plant employees, and thus increases their interest and sense of ownership for the rehabilitation. In general, the range of different parties involved in this project has allowed for a number of promotional opportunities through academic publications, as well as educational opportunities.

A number of students from both institutions are using this site as the location for both undergraduate and graduate thesis work, while many other students will be gaining valuable restoration/rehabilitation experience either as part of their course work or through employment opportunities created by the project. An initial planting day, for example, involved a number of additional students from both institutions, and some CTYEC staff and executives, as well. The site has been, and will continue to be used for study field trips to observe and participate in the work in progress.

What are the Benefits of Collaboration?

The Benefits for the Client Collaborators

The main advantage achieved by the client in these collaborative projects is the generation of ideas and alternatives in a way that is non-threatening, non-committal and cost-effective. They are able to take advantage of the wide range of perspectives, insight, and experience of the students (and their experienced instructors), and incorporate the ideas and enthusiasm generated to the advancement of their own objectives. Sometimes they get ideas about what to do, other times, how it might be done.

The benefits that accrue to the client collaborators in this process range from the tangible products that are provided in terms of plans, sketches, and reports, to a variety of broader and perhaps fundamentally more important intangibles. In these studies the students take on the role of consultants (supervised by their instructors) to provide a design service meant primarily to generate ideas for the client in a situation that ultimately leads to some sort of real-life implementation, although not necessarily by the students or according to their exact specifications.

Perhaps one of the greatest benefits is that the students bring an openness to the possibilities. They have the ability to provide a free and fresh response to problems and solutions, which is driven in part from not being a "part of the system" and in part through a combination of enthusiasm, idealism, naivete, persistence, and even arrogance that is not afraid to be challenging. They are also not jaded by the blinders of "practicality," (which can be both good and bad). This all allows them to "push the envelop" and open up options that may not have previously been considered.

Through the experience of interacting with the students, and particularly as a result of presentations, the clients are often put in touch with others who may be able to shed additional light on their problem, or provide insight into solutions. Sometimes the greatest benefit is simply getting people from the same organization talking to one another. That certainly was the case with the Trent-Severn project, in which important communication was established between national, regional and local components of Parks Canada, just by getting many players into the same room at the same time to review the student work.

Sometimes the benefit arises from the networking that happens between participants. The student work for Hamilton Harbour over a two year period brought many stakeholders in the region of Hamilton Harbour into the same room, several times, including municipalities, private industry, and other environmental agencies like the Royal Botanical Gardens and the Canada Centre for Inland Waters.

Sometimes the benefits may be the introduction of clients to other professional or technical people who can further address a particular aspect of a problem, or provide additional insight. At open houses ecologists have been observed talking to corporate managers, engineers talking to biologists, maintenance personnel talking to landscape architects.

The student work may also provide an important political role, especially if there is controversy involved. The students are seen to be "neutral" and perhaps somewhat naive (although given some of the experience of the students this is far from the reality). Because they are not part of the institutional or corporate "system," nor are they professional consultants who may not wish to offend their client, they are therefore given a lot of latitude in the way they analyse a problem and propose solutions. This means that they can raise issues and controversies that it would be "politically incorrect" to do, say within an agency, or between agencies. For example, in some of the work in Cootes Paradise, the students were able to challenge some of the assumptions of the approaches to wetland restoration that were at the time apparently failing. They were able to raise the issue of an outside employee amenity area for the steel products manufacturer, which was side issue in a potentially festering labour dispute. For CYTEC Canada, the students persisted in making recommendations for relocation of a perimeter fence, for improved corporate signage, and for an employee amenity area, which were not central to the terms of reference of the project, but the desirability of which has now been established.

The student work, therefore, becomes a "gentle" or perhaps even "safe" way to promote certain ideas or concepts. Indeed, for some of the work for Hamilton Harbour, that was a deliberate intention – in a way to "shake up" some ideas, and motivate action amongst the diverse stake-holders.

The other side of this is the opportunity to deliberately use the students' work to advance a particular agenda. The option to use the students' work for publicity, internal to an organization or within the large community has great potential. For the steel products manufacturer, a presentation of proposals was used to try to generate employee support for the idea of site improvements. The students' ideas for a trail along railway lands in Hamilton's West Harbourfront urban development area were used as preliminary proposals as part of a major urban development scheme. CYTEC Canada has used samples of the students' ideas to promote its efforts in rehabilitation at a Chemical Producers' Conference.

The Benefits for the Student Collaborators

These projects provide the students with exposure to the issues, knowledge and practices of landscape restoration, rehabilitation and reclamation. They gain some practical experience, and learn about the diversity of the problems and the potential solutions. The student collaborators are highly motivated by the fact that they are working on a "real" project, that there is potential that the work they do may find some form of implementation after they have completed their work, or, in other words, what they do might actually mean something!

These studies provide a wonderful opportunity for the attainment of the academic objectives of the landscape architecture program, which balance the acquisition of the requiset knowledge base and skills sets of landscape architecture with the ideals and attitudes of professionalism. The graduate students are able to bring their academic skills and past academic and work experience to bear very quickly to learn much about site analysis, ecology, plant materials, design, and landscape management, and do an amazing job of acquiring high level skills in plan and report graphics, report writing, and verbal presentations.

Furthermore, these studies provide an introduction to and a forum for the discussion of many issues, not all of which are environmental. There is always spirited debate on the assumptions of naturalization, and the use of native plant materials or the relevance or effectiveness of particular restoration techniques. But discussion also expands to the tough broad issues of resource use conflicts, or definitions of environmental health, or political debates over such issues as jobs *versus* the environment. There is frequent discussion about roles and responsibilities of the many players. Some of the discussion challenges the students' stereo-types and assumptions, by putting them in the difficult position of making compromises and tough decisions for themselves, rather than being passive critics.

One of the main benefits to students is that they get practical experience in both design and project management They are involved in activities that can be directly observed and evaluated. The students thus gain an exposure to the issues of being a professional consultant. They learn many practical lessons about running a consulting project. They usually must respond to a client's terms of reference, and establish a working consultant/client relationship. They are given the opportunity for client contact, and must learn how to read some of the motivations and agenda of the players, and the ways in which they must interact with them. They learn about meeting dynamics and hidden agendas, for example. They are also exposed to the budget and financial aspects of a large project. .

A lesson that is sometimes learned with difficulty has to do with the ability to work together in teams. Because of the amount of work they are asked to do, the relatively short time frame, and the realization that no one individual

can have the knowledge base or the skill sets that are required to accomplish the objectives of the project, they are required to work together to meet their objectives. This requires the development of organizational, co-operative, and dispute resolution skills that are sometimes hard-won.

It also becomes very clear to the students early on that the task of industrial land reclamation is one that demands the skill and co-operation of a variety of players and professions, and that in the big picture, too, no one group has all the skills that are necessary for the successful implementation of a project. They are often exposed to and required to enter into liaisons with other professions. In the case of CYTEC, co-operation has expanded to include students in other disciplines from the University of Waterloo.

The students are also given a directed opportunity to exercise their creativity, and to get feedback that extends beyond the walls of the classroom, from their clients, invited guests, community members, and professionals in a variety of disciplines who are invited to presentations or who otherwise participate in the projects as contacts, advisors, or reviewers of the students' work.

And the students learn a lot from each other. The mutually benefit from the various skills and backgrounds that they each bring to the project work. They also learn a great deal from observing the range of alternative solutions that are innovated by their classmates, in a way that goes far beyond the limitations of their own project focus. They particularly learn from the contrast between sites and between solutions.

The Benefits for the School of Landscape Architecture

The School of Landscape Architecture is a beneficiary of these studies too. Certainly, these studies provide the opportunity to meet academic requirements in an involving, hands-on way – putting into action the ideals of participatory education, learning by doing. However the school also benefits financially, from the dollar support provided to assist the students and the School. The School is able to participate in the wider community, giving something back by providing a community or environmental service. Reciprocally, it gives the School some profile amongst the community, industry, and government. It also promotes the skills and talents of the School's students, some of whom are given employment opportunities either directly or indirectly as a result of the project or exposure to a hiring agency, which in turn helps to establish a good reputation for the School and its graduates. And, of course, the instructors gain experience themselves, extend their contact networks, and gain recognition for the work accomplished.

The Benefits for the Profession of Landscape Architecture

These studies also provide exposure to clients and the community for the profession of landscape architecture. Perhaps the most gratifying comment for a landscape architect or landscape architecture student is the comment often heard at student presentations that "I didn't know that landscape architects could do that!" Landscape architects often feel misunderstood and underappreciated, and such studies as these allow for the promotion of the particular skills that this profession can bring to bear in restoration, rehabilitation or reclamation projects. These skills particularly have to do with design, the visualization of design concepts, implementation of schemes, and landscape management. The studies validate the important role of landscape architects in the multi-disciplinary environment in which these kind of studies must occur and foster an appreciation for collaboration with other participants who have different skills and contributions.

The Benefits for the Environment and the Cause of Industrial and Reclamation

Certainly, the underlying motivation for all this work is ultimately to effect some kind betterment of the environment. The point is to improve water quality, to restore the integrity of ecological systems, to make new habitat, or to promote native species. This is, of course, fundamental to the assumptions of the profession of landscape architecture and landscape architectural education. This is simply one means for achieving these objectives.

Beyond the parochial self-interests of the various participants in this process, there are real benefits to the environment that do result from this activity. Some of these benefits are very tangible – that is the creation of new habitat, or improved aesthetics, or shoreline stabilization. And while the in-ground solutions may not look exactly as the students originally designed them, the students' activities and energies do often motivate a physical response – real environmental improvement.

Some of the benefits, however are more intangible, and have to do with the promotion of social attitudes that promote awareness of natural systems and the mind set that fosters environmental improvement. The work opens up to the clients an awareness of the options and opportunities which lead to the motivation to effect positive change. For some of our clients, the idea of "naturalization" is a new concept, especially in an institutional setting with traditional practices of grounds maintenance. Certainly this was the case for the work on the Trent-Severn and Conestoga College, and the City of Burlington. The bio-engineering options for stream bank rehabilitation, shore stabilization, and slope stabilization became real options for a number of our Hamilton Harbour clients. The students' work has opened up internal institutional discussions about ecological integrity, and bio-diversity, and the use of native plant species and local genetic material, and issues of wildlife management, and control of invasive species, and on and on.

These issues and debates are thus injected into the corporate or institutional or community culture of the clients, all of whom have some measure of responsibility for landscape management. So in various ways, the concepts eventually work themselves out into the environment, perhaps incrementally, perhaps slowly, but always inexorably, resulting in shifts toward environmental improvement. The response may be as simple as the installation of bird boxes, as fundamental as not cutting the grass any more, or as complex as a comprehensive restoration masterplan

Problems

These studies are not without their problems and frustrations.

One of the major limitations simply is time. Within the frameowrk of a course, projects have to be completed in the very short time frame of a single semester, in which the same course has other objectives too, and during which the students concurrently take other demanding courses. This often means that it is not possible to do the depth of research that would be desirable, or to explore as many options as would be optimal, or to achieve a more precise level of detail. It is actually quite astounding what the students are capable of achieving within these limitations.

One of the initial difficulties sometimes has to do with attitudes. Sometimes the students come to a difficult reclamation problem with environmental prejudices. It is not uncommon for students to be biassed by a kind of pure idealistic environmentalism, which at one end of the scale says that if we have an apparently pristine environmental condition we should not touch it, and at the other expresses deep disgust at the extent to which we

have defiled the landscape. It is also not unusual for the students to bring to the table deeply held negative stereotypes of industry. On the opposite site, the clients sometime harbour a great deal of suspicion of the students' attitudes and agendas, and concern for their lack of practicality. There is also in industry a sometimes not-so-subtle distrust of academia. These attitudes need to be overcome in order to establish the proper rapport required to undertake a project. However, this generally happens quite quickly as the students grow into their role as consultants working on behalf of the objectives of the client and the client becomes comfortable that the students are responding to their objectives.

There can be a myriad of logistical and operational problems. For example, the schedule of the client has to be adaptable enough to dovetail with the calendar of the academic semester. Arrangements need to be made for meetings and site visits that usually have to fall within assigned class times, because the students, of course, have other academic obligations. In order to be reimbursed for expenses from the project budget, students have to be diligent in keeping records and receipts, which for some is a new set of skills. Some sites provide problems of access. One Hamilton Harbour site, for example, could only be accessed across a CNR Rail line, unauthorized crossing of which contravenes federal law. Other sites lie behind fences and closed gates, and require security authorization to enter. The nature of some reclamation sites raises issues of liability and safety. (The university carries liability insurance for students on authorized filed trips.) Some sites require the use of hardhats and safety boots. It is difficult to manage studies at sites distant from Guelph, which compromises a students' ability to easily return to the site for further study.

There are always data problems too. Getting base maps is often a challenge. It is even a bigger challenge to get base maps of an appropriate scale that are current and to a sufficient level of accuracy. The availability, quality, and consistency of background data is often quite poor. There is usually a dearth of important information regarding such things as topography, soils, hydrology, site history, infrastructure, and so on, all of which compromise the quality of the end product, and which have to be dealt with rather more abstractly and intuitively than would be the ideal.

There is also a lack of easily accessible technical and scientific background data to inform the process. While the students are quite adept at turning up relevant research data, technical information, and precedents, there is never enough time to do systematic research or to methodically integrate what is found into the design process.

One further limitation is that while the nature of the problems the students tackle is very complex, it is not generally possible to make available or to learn all the disciplines that are required to successfully solve a problem. The students are not able to learn very much about successional dynamics, or slope engineering, or hydrology, or shoreline dynamics, or the chemistry of contaminated soils, for example. They do learn, however, how important these things are, and how much reliance is necessary on allied professions in such complex projects.

The time limitation also imposes practical limits on what can be accomplished in the production, quantity and quality of drawings and reports, although the clients are always quite impressed with what they see.

Another issue that has come up has to do with perceived competition with practitioners in the private sector – that is, whether the student projects compete with and undercut professional consultants. The reality is that because of budget limitations, this work is not likely to be undertaken by professionals at the typical stage at which the students are brought in. The scope of work is often quite undefined and quite broad, and would certainly not be practical or economical for a consulting office. Essentially there is no money in it. On the other hand, the further development of the work is an opportunity for professional involvement, which has indeed

occurred in a number of instances. The School of Landscape Architecture is quite aware of this issue, as is the Ontario Association of Landscape Architects, the professional organization representing landscape architects in Ontario. It is the contention of the School that student involvement in such projects meets a community need, and actually promotes the skills of landscape architects in the greater community, which ultimately leads to improved consulting opportunities.

Summary

What Have We Learned along the Way about Industrial Land Reclamation?

So, what have we learned about restoration, rehabilitation, and reclamation as a consequence of the experience accumulated along the way in undertaking these student studies?

First of all , we have learned that when it comes to industrial land reclamation in particular, the problem is immensely diverse and complex. One of the most important lessons is that each and every situation is unique. The complexities of site conditions, site history, on-going ecological processes, the state and extent of disturbance, and the objectives of reclamation are always different, and always site specific. This, of course, makes it difficult to project a solution for one site to another. Each project is an experiment.

Another important lesson is that models of natural systems are not necessarily the appropriate models for restoration and reclamation sites. What model can adequately replicate heavily and continually human modified conditions like the artificially high water levels on the Great Lakes, or the erratic displacement wake of ships passing through a canal, or the alternating alkaline and acid substrata of a filled industrial site?

We have learned that the use of native plant materials can be very difficult to achieve on heavily disturbed industrial sites. This precipitates a debate on the appropriateness of always using native plants which can pit pragmatists against purists. As one project reviewer said, "Why use native plants when you don't even have native soils?"

We have learned that there is little understanding of long-term successional processes on various kinds of industrial lands, but we strongly suspect that they do not always follow ideas of how things are supposed to work according to our current modeling, which, once again, is most frequently derived from the baseline processes operant in "natural" systems.

We have learned that while there is a lot of information of a theoretical, research, technical, and experiential nature available on the restoration of certain "ideal" habitats, like prairies or Carolinian forests, or wetlands, there is precious little available on the design and creation of specialized habitats, like slough forests, wet meadows, or alvars. Most of the data available for forest restoration, for example, relates to deciduous or mixed forests. There is little data on how to design boreal forests, with ecological imperatives in mind, rather than the commercial objectives of forestry. On the other hand, commercial forestry planting techniques may have much to offer in terms of establishing large areas of naturalized forest too.

We have learned that while there seems to be a lot of work going on in this area, there is not a whole lot that has been published and is readily available. Published precedents are hard to come by, although we know that there is a richness of experience which resides in individuals in consultancies and agencies. We have also become aware that some of this information is suppressed for proprietary competitive advantage, or for because of interdisciplinary rivalry.

We have learned that landscape management is very important. It takes time to make a forest or a wetland, and this demands on-going involvement in the landscape. The job is not done after the design is finished and installed. A long-term commitment is required to get the landscape going, and to keep it the way it is intended. The weeds need to be suppressed. The prairie needs to be burned or mowed. The forest needs to be thinned. This all takes commitment of time, resources, and expertise.

Perhaps the most important lesson is to expect the unexpected. While this is likely universally true for any habitat restoration or landscape design project, it is especially true for industrial land reclamation, in which it is impossible to predict what one may encounter. There are few reliable rules, and always lots of surprises.

Where the Work Leads

While the work undertaken within the framework of the Plants and Environment class itself only lasts as long as the Fall semester of the academic year, the seeds planted sometimes do germinate, and the ideas take on a life of their own. This happens in a variety of ways, as the CYTEC case study illustrates.

The main objective of the exercise for the client collaborators is the injection of ideas for the real problems for which they are looking for solutions. And while the precise physical solutions proposed by the students may or may not be appropriate or practical, their concepts are often embraced and enhanced or re-worked in such a way that is compatible with the clients' objectives and mandates. Parks Canada carefully reviewed the work for the Trent-Severn Waterway, which was used by the Cornwall Regional Office to promote to the ideas of naturalization for lockstation sites to the Regional Waterway managers and lockstation management and maintenance personnel. Students were hired (although not necessarily students who had been in the course) to work in the Cornwall office to further develop implementable naturalization plans for a number of lockstation sites.

In the Hamilton Harbour area, the students' work contributed to a growing body of naturalization and reclamation work occurring in the area. A number of the sites worked on by the students were deliberately selected to illustrate what further kind of work might be done. Much of the early work in Cootes Paradise and Hamilton Harbour itself (prior to student involvement) was focussed on wetland restoration or aquatic habitat creation. A number of the student projects were selected to illustrate the need also to address the possibilities for upland terrestrial habitat restoration and stream restoration back from the shoreline. Others were selected to point to the need to tackle the tough sites on the industrial side of the Harbour, extending thinking beyond the conservation or re-creation of more "natural" systems elsewhere along the Harbour perimeter or in Cootes Paradise. The City of Burlington embarked on a naturalization program for a park along the lower reaches of Grindstone Creek in part inspired by student work. The City of Hamilton took some of the ideas for a trail in the West Harbour area, and have further developed them as part of a major redevelopment plan proposal, and hired some Guelph students to assist with the work..

Sometimes the client chooses to further the work by hiring professionals. The steel products manufacturer, for example, retained the services of one of the authors, Larry Harder, working professional capacity, to develop a series of alternative site development plans for their property. This work was exhibited at the plant as a way to generate support for the ideas, although the economic concerns of the company precluded any imminent action on them.

There are other spin-offs from this work as well. Out of the student work, gaps in knowledge and new research needs are identified that help contribute to the understanding of the concepts and practical implementation of

restoration projects. As mentioned, it has been discovered, for example, that very little has been published on natural vegetation succession on heavily disturbed industrial sites, and that there are very major gaps in knowledge when it comes to particular kinds of conditions. For instance, out of mining reclamation research there is a lot of data on how to deal with high site acidity, but not very much that effectively addresses highly alkaline conditions. There has been little long-term monitoring of the success of reclamation projects, especially in the southern industrial areas of Canada.

The student research starts to address new areas of concern, and slowly adds to the body of knowledge related to restoration, rehabilitation and reclamation. The bias that the students bring to the research has to do less with pure science than it does with applied research that informs design, construction, and management. As landscape architects, this is the focus of their intentions.

As a result of these projects, students have researched a widening range of habitat types, including alvars, slough forests, carrs, robust "industrial forests" consisting of persistent pioneer woody species, and successional revegatation on toxic dredge spoils. They have explored wildlife habitat creation opportunities, such as restoration of habitat for fish and shoreline nesting birds, as well as wildlife pest control techniques, such as control of Canada geese and discouragement of cormorant nesting. They have tested the application of techniques such as bio-engineering and remedial wetlands, and explored the geometry of shorelines, islands, and stream alignments. They have explored alternative establishment techniques, such as the revegetation of woody plants on wastes using direct seeding techniques. They have explored species compositions adapted to particular kinds of site conditions. They have further examined site preparation strategies such as green manuring, cover cropping with nitrogen-fixing species, and application of bio-solid wastes as soil amendments. There have also been some extremely innovative exploratory design proposals including one proposal for floating islands and another for an "ecological freeway," comprised of a vegetated overpass to link several naturalization areas on either side of the Queen Elizabeth Way in Hamilton.

Some students who have been involved in these projects go on to develop their proposals further as competition entries or thesis work. A 1995 proposal for the heavily polluted Windermere Basin in Hamilton Harbour by students Glynis Logue and Scott Henderson, for example, was one of several projects coming out of this course work that won a Canadian Society of Landscape Architects student award. MLA thesis work has also evolved out of these projects. For example, former student Angela Coulas completed a thesis that looked at aspects of the physical design of decommissioned sites contaminated with extreme levels of radio-active wastes. Glynis Logue, was hired by the Royal Botanical Gardens for a summer to develop an amphibian habitat restoration project adjacent to Cootes Paradise, and has evolved her work into a thesis on design and management for amphibian metapopulations. Petra Kuehl has begun the exploration of revegetation patterns on industrial wastelands, and is working on a site in Pittsburgh. Other investigations have been also done or are on-going in the areas of wildlife habitat creation and phyto-remediation.

Conclusion

Industrial land reclamation is a very complex, multi-disciplinary endeavour, in which many participants play a variety of roles. There is no question that the task of reclamation is enormous, the challenges many, and the need great. The contributions of all players are necessary to advance our collective objectives of redressing the negative legacy of our industrial history. Landscape architecture, and landscape architecture graduate students are playing an important role in their own way in this endeavour. The circumstances related in this paper are a testament to what is possible. These examples point the way to the kinds of collaborations that will help us cast our gaze forward into that optimistic future.

Our students are our future. It is hoped that with experiences such as these, our students will be sent forth into the new millennium, as skilled professionals, ready to do their part with others, equipped with the right tools. ironically, to solve the problems of the past.

Reclamation and Restoration of Settled Landscapes

September 27th – 30th, 1998
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