OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

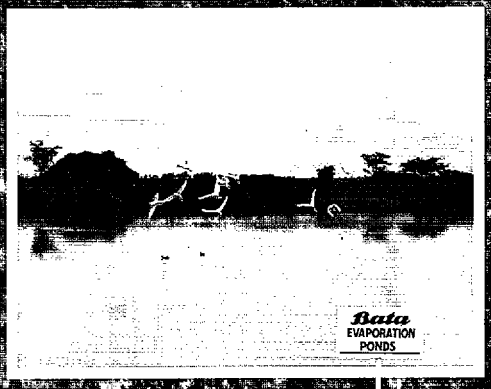
Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

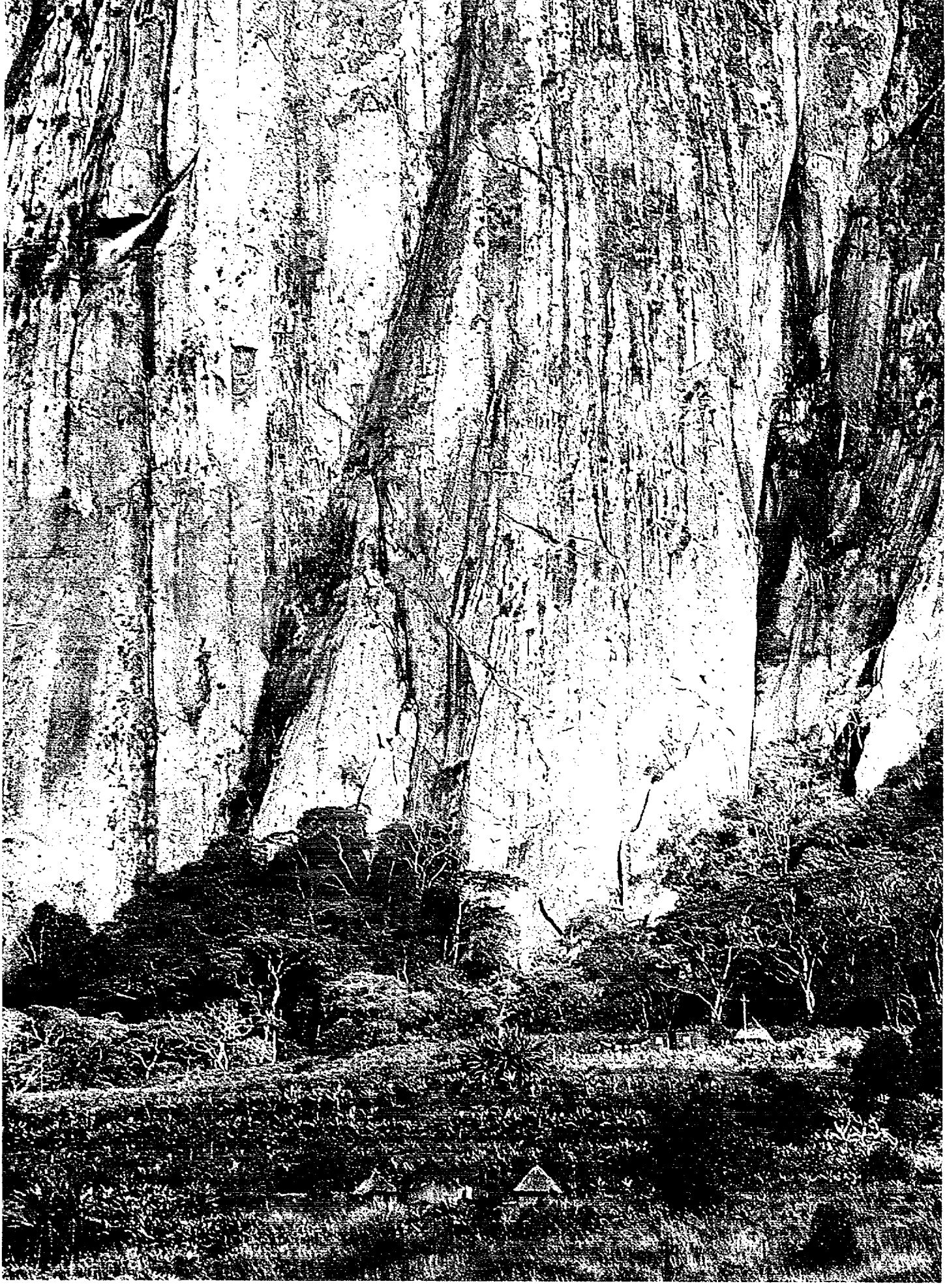
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

Turning the Effluent Tide

Zimbabwe's Leather Makers Rise to the Challenge of Environmental Stewardship

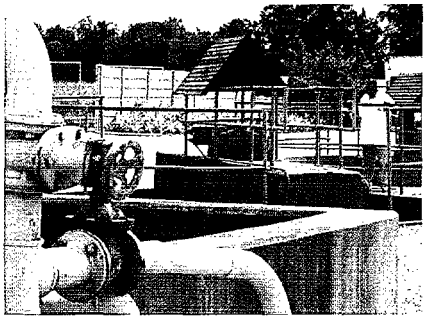


UNIDO



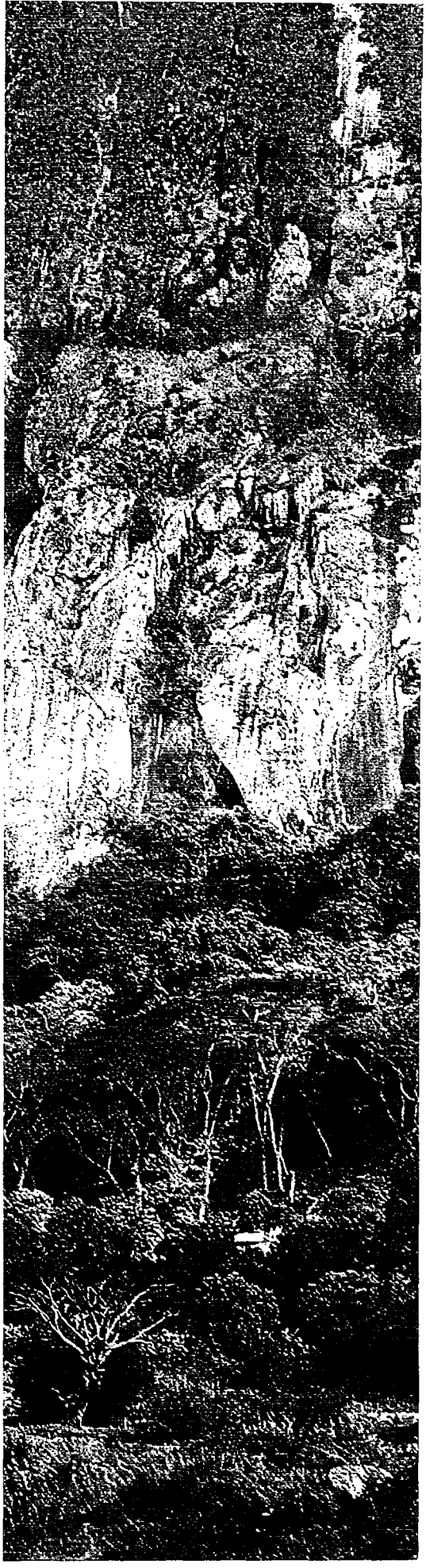
The Daunting Task of Dealing with Tannery Effluents

Few industries can claim a history as long as that of leather making. The conversion of hides and skins into leather dates back to mankind's earliest times – and today it still follows the same basic procedures. Various organic or mineral tanning agents are used to impart to leather desirable features of feel and wear.

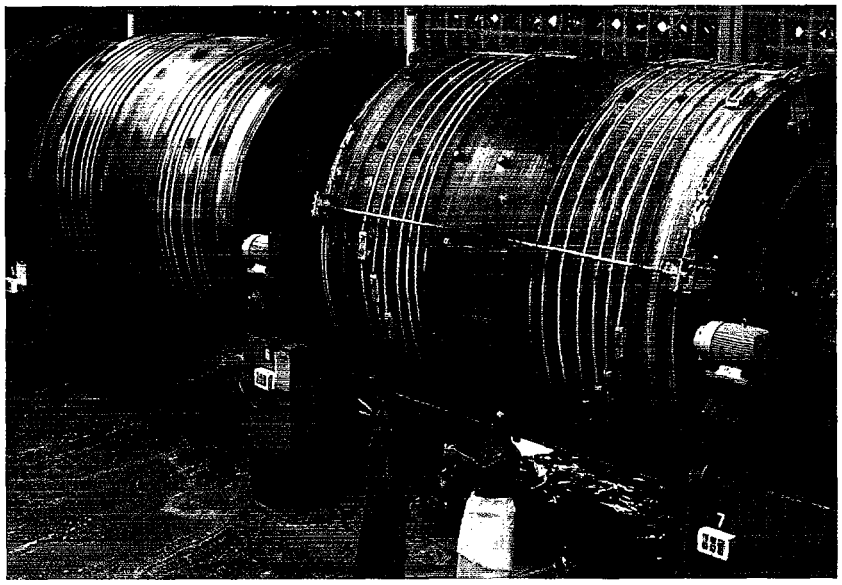


Tanneries are water guzzlers, and all tannery wastewater, carrier of large amounts of spent chemicals as well as organic matter from the raw material processed, is ecologically harmful. Cleaner technologies and better housekeeping and production practices can help reduce water and chemical consumption as well as pollutant content. Nonetheless, the treatment of what comes out at the end of tannery pipes is essential in containing the adverse environmental impact of leather making.

Zimbabwe, like many other African countries, relies on its leather industries as a source of significant income. Its tanneries, all private enterprises and some of them associated with downstream facilities manufacturing footwear and other leather products, are among the continent's most successful exporters. They were also among the first industrial companies to answer the call for environmental stewardship in a country where pristine natural beauty and fertile lands are highlights of the nation's heritage. (Taken by award-winning photographer Ian Murphy, the opposite picture and those in the adjacent and the following sidebars offer a glimpse of the environmental treasures Zimbabwe's industry is called upon to protect.)



With processing capacities above 10 tons of raw bovine hides per day, each of Zimbabwe's seven major tanneries face the daunting task of dealing with a daily discharge of hundreds of cubic metres of effluent. At the same time, they are striving to increase productivity and improve product quality in order to strengthen their market positions at home and abroad. An additional challenge is the growing pressure from effluent-quality regulations that tend to be more stringent than in many other places, including non-African countries.



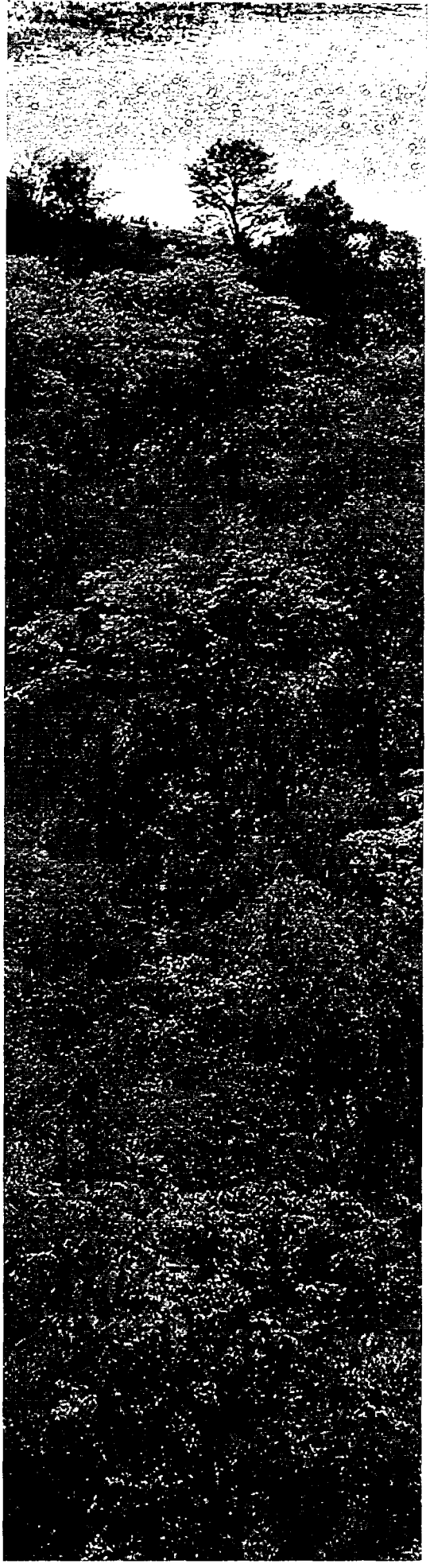
To give a decisive boost to the steady pollution containment improvements made by Zimbabwe's tanners over the past decade, the United Nations Industrial Development Organization (UNIDO) launched a custom-designed project in January 1999. Financed by the Government of the Netherlands, it is primarily aimed at upgrading the effluent treatment facilities at three leading tanneries: Deraswiss Zimbabwe in Kadoma, Eagle Tanning in Marondera, and Imponente Tanning in Harare. The assistance provided is based on technical assessments made by international and local experts with distinguished track records in the Organization's three-decade involvement with the African leather industries. The project itself is closely integrated in the UNIDO Leather Programme in Eastern and Southern Africa, and Zimbabwe's showcase leather maker, Imponente, was among the beneficiaries of a large-scale tannery modernization project carried out in the early 1990s with funds provided by Italy.

Some US$350,000 in equipment expenditures shored up substantial investments already made by the three companies and paved the way for big gains in pollution control. Technical know-how has been channelled in cooperation with the Leather Institute of Zimbabwe

in Bulawayo (an organization supported exclusively by the industry) and the National Cleaner Production Centre set up in Harare in 1995 by UNIDO and the United Nations Environment Programme. A widely attended workshop on the operation and monitoring of tannery effluent treatment systems was hosted in October 1999 by Zimbabwe Bata Shoe Company in Gweru, the country's oldest leather manufacturer and a high-profile participant in the project.

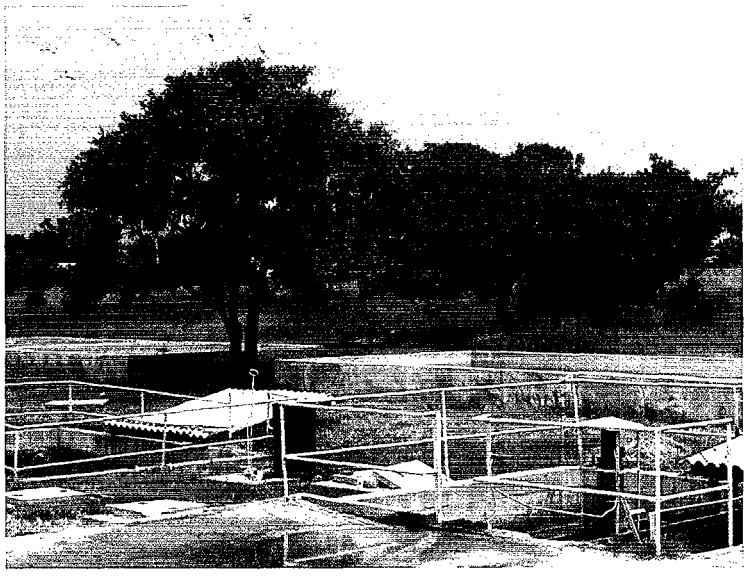
Gradual project-driven progress in applying new technologies augurs well for an effective ultimate blend of cleaner production and waste management, the only viable long-term solution to the challenge of adverse environmental effects caused by industrial activities. At Imponente as well as in Bulawayo, where three tanneries use a common effluent treatment plant to access the municipal sewage system, practical tests and technical assessments have underscored the benefits of introducing hair recovery in beamhouse processes. A pilot anaerobic sludge digestion operation undertaken at Bata's tannery is a promising exercise in tackling the towering problem of solid wastes. Finally, a revolutionary large-scale application by the same company of a natural complementary treatment of tannery effluent has turned a wastewater pond into a waterbird sanctuary.

The overall benefit from the current project is expected to be a drastic reduction in the main components of the effluent pollution load, from COD/BOD_5 (up to 60 percent) to suspended solids (up to 90 percent) and chromium and sulphide (over 90 percent).



Deraswiss Zimbabwe

A top performer in the Deras Group, which operates in several countries, Deraswiss Zimbabwe was established in 1991 in Kadoma, where it manufactures wet blue for export and for its own leather finishing facility in Harare. The tannery frequently manages to secure sufficient raw hides for its full processing capacity of 11 tons per day. Like its textile industry neighbours on the outskirts of this small town surrounded by orchards and cotton fields, it has kept most of the citrus, mango, guava and other fruit trees that came with the property; today some of them display their laden branches within steps of wet-blue stacks and effluent treatment tanks. The fruit trees and a resident flock of cattle egrets seem to herald the environmental awareness which has taken firm roots at Deraswiss.



The treatment of a daily effluent discharge of 250 m^3 is the target of an extensive upgrading effort supported by the UNIDO project. The filtration of the separate beamhouse and tanning effluent streams has been improved. Structural modifications and new equipment are to achieve a more effective removal of chromium from spent tanning liquor; the company expects an ultimate 95 percent reduction in the chromium content of the tanning effluent. A buffer tank will

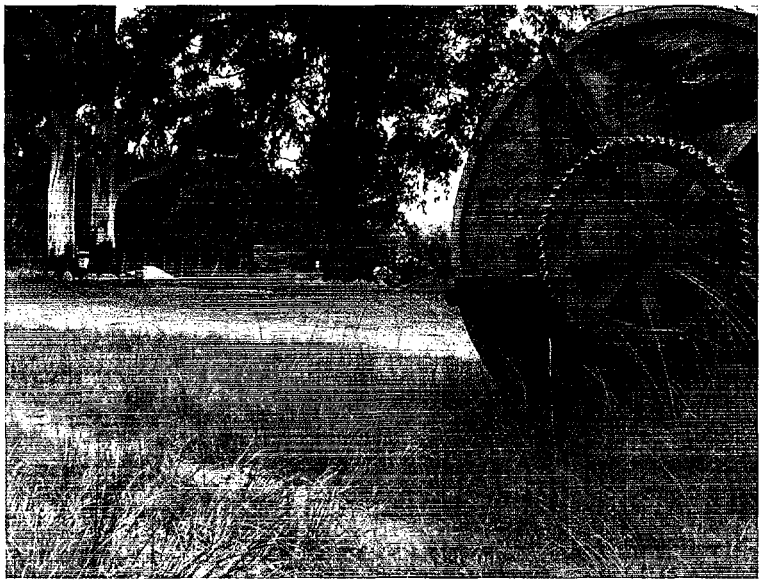
soon be inserted in the treatment chain to regulate the effluent flow before it reaches the flocculation stage, where additional benefits are gained from automatic dosing units.

Eight new sludge dewatering beds will double the aggregate surface of the existing ones (400 m^2) to meet the requirements of full capacity utilization and to avoid backups during the long rainy season. The disposal of dried sludge and other solid wastes is a major problem with both environmental and cost implications. Deraswiss uses the municipal sewage system and landfill to discharge its treated effluent and solid wastes respectively. The company has succeeded in keeping its water consumption fairly low, which is one sound solution to the challenge of effluent and, consequently, sludge volume.

The COD load of the treated effluent is expected to show declines of up to 60 percent once all treatment improvements are in place. To fine-tune the system and monitor its performance effectively, the company is setting up a laboratory that will conduct regular tests of effluent samples.

Eagle Tanning

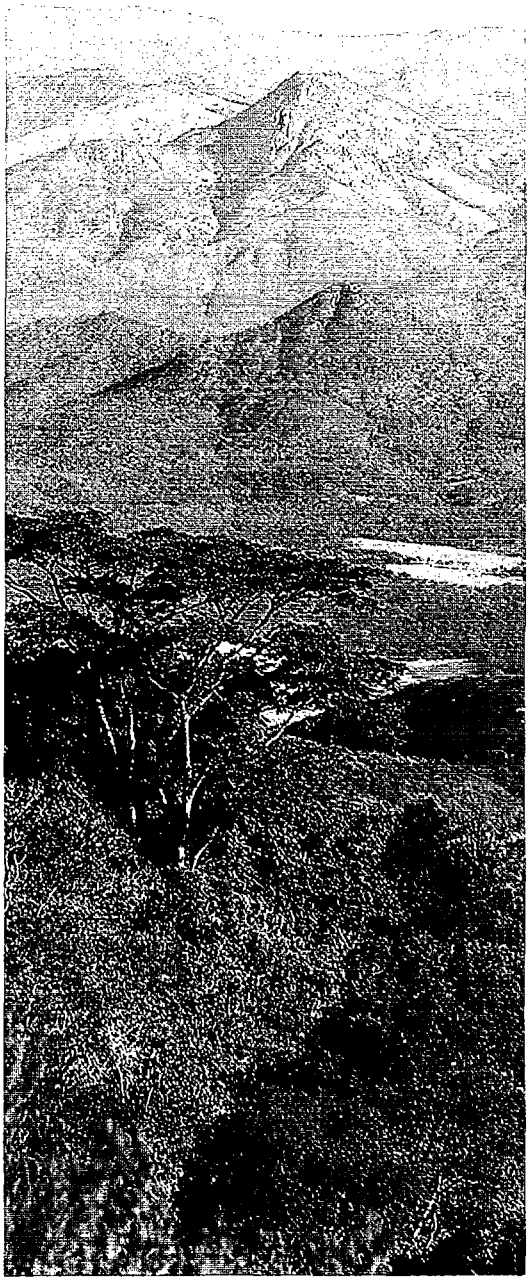
One of the country's oldest and largest tanneries, Eagle has over 100 employees and a processing capacity of 15 tons of bovine hides per day. It exports, mainly to Europe, up to 80 percent of its production of wet blue and converts the rest into crust and finished leather. The tannery is tucked away in the fertile folds of the mountainous breadbasket region around Marondera, the last major settlement en route to the breathtaking vistas of the Eastern Highlands. Hugged by a 600-acre eucalyptus plantation in its own extensive grounds, the manufacturing facility is a self-contained community with tidy employees' quarters and an elementary and a secondary school. By necessity rather than choice, this self-reliance extends to its endeavours to control pollution.



Hampered by distance and a less than accommodating Marondera Town Council, the company has resigned to the fact that its access to the municipal sewage system is a remote possibility. It pumps its effluent into its own evaporation lagoons, bottom-sealed to prevent seepage, while the dried sludge and other solid wastes are dumped at a landfill site also located on its land.

Several key interventions under the current project bode well for the future performance of the effluent treatment plant which, at maximum tanning capacity, has to handle a daily flow of 600 m^3. A more effective removal of chromium is to be ensured by an automatic lime-dosing unit as well as additional equipment and tanks. Two automatic pumps will soon improve flocculation. An overhauled DAF (dissolved air flotation) unit and a new one will operate in parallel to reduce the amount of solids escaping to the evaporation lagoons. Finally, the company is building additional sludge dewatering beds and will acquire effluent testing equipment.

With support from the National Cleaner Production Centre in Harare, Eagle has charted a cleaner technology course for its tanning department. As a key factor, it will purchase two advanced drums that will allow it to embark upon a strategy of high chromium exhaustion in the tanning process. In addition to substantial savings (the payback period for the main investment – the two drums – is estimated at 20 months), the new technology will contribute to a significant decline in the pollution load of the tanning effluent.



Imponente Tanning

Part of Superior Group, which also includes a shoe factory, Imponente is Zimbabwe's most modern tannery. With a workforce of 200, it processes up to 20 tons of raw hides a day into wet blue, crust and over 100 types of finished leather for footwear and furniture upholstery. About half of its production is exported to Europe, Australia and neighbouring African countries. The company's growing profitability over the past decade has moved hand in hand with substantial investments in machinery, R&D and workers' skills.

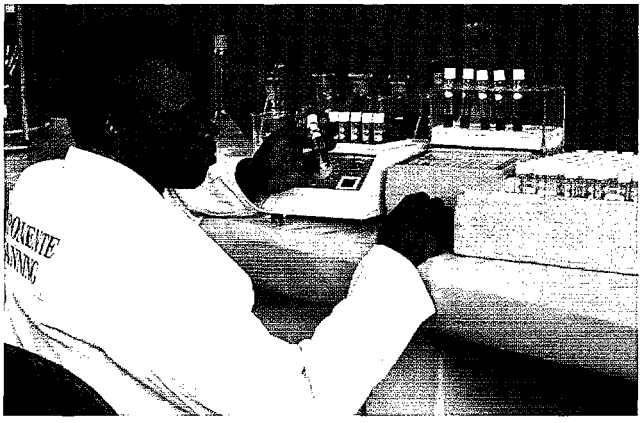
Imponente's business performance is fully matched by its environmental record. The tannery's well-deserved clean-manufacturer image is most befitting given the company's location: its hometown, Harare, with its ubiquitous jacaranda and flame trees in riotous blossom, is a garden city par excellence. Imponente won the Environmental Protection Award granted by the Natural Resources Board of Zimbabwe and is entitled to take eco-labelling credit for the use of water-based finishers (instead of solvents) and other clean technologies. In light of a recent assessment, it stands a good chance to receive ISO 14001 certification before the end of 2000.

The UNIDO project was a welcome opportunity for the tannery to further improve effluent quality and build on the benefits of its cleaner

production achievements such as a remarkable success with high-exhaustion chromium tanning and a very low water consumption. In addition to structural modifications of the treatment system, a belt press unit will soon be installed to dewater the sludge separated from a daily 450 m^3 of effluent. Another advanced piece of equipment commissioned recently to reduce the volume of solid waste is a compactor for shavings, trimmings and buffing dust (the volume reduction is over 75 percent).

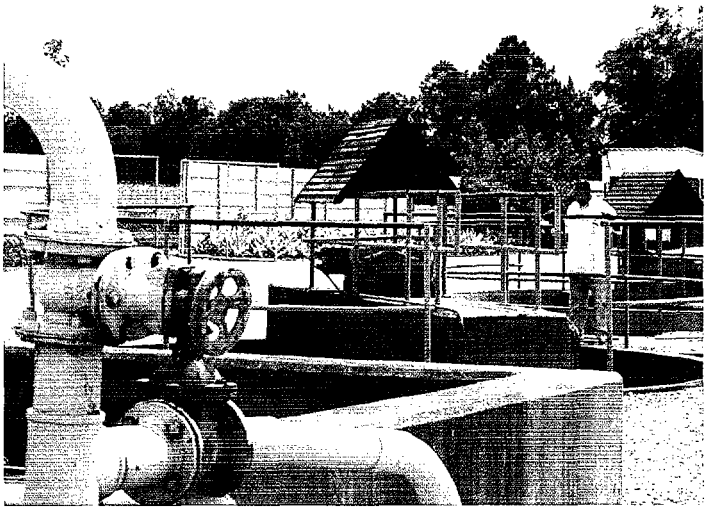
In a glass box overlooking the liming drums, Imponente's laboratory runs hourly tests of effluent samples on a new US-made Hach spectrophotometer (below). The company estimates that an ultimate decline of over 50 percent in the COD readings of the effluent tests is a realistic expectation.

The management at Imponente is manifestly aware of the business dividends of cleaner production and discharges. It applies consistently an "environment-oriented cost management" mechanism designed to detect ways and means of achieving cost gains by reducing waste and pollution. The current upgrading of the company's capability to treat its effluents and dispose of its solid wastes underscores the viability of this strategy: substantial savings in dumping fees, penalties and transport costs ensure relatively short investment payback periods and much leaner operating costs beyond them.



Zimbabwe Bata Shoe Company

Gweru, a key railway junction and the largest town between Harare and Bulawayo, was the site where Bata built the country's first tannery in 1939. Today the company employs over 3,000 people and makes leather exclusively for its own footwear production, one of the largest among Bata's worldwide manufacturing operations. Pursuing its time-honoured corporate policy, Bata has a strong symbiotic relationship with the local community, which it serves effectively well beyond the provision of employment. Environmental care is a top priority, and the treatment and disposal of the tannery's effluents and solid wastes are a role model for Zimbabwe's leather industry.



Hosted by Bata in October 1999, the project-sponsored workshop on the operation and monitoring of effluent treatment plants was attended by managers and technicians from all the tanneries in the country as well as environmental protection officials. Presentations by foreign and Zimbabwean experts were complemented by practical sessions, and arrangements were made for future operator training at Bata's facilities.

For two separate attempts to harness the potential of new technologies, the company secured, under the UNIDO project, the services of an expert from South Africa's Rhodes University. A small-scale anaerobic digester of tannery sludge has been in satisfactory operation for several

months now. The digestion rates seem to confirm the feasibility of installing a facility capable of handling Bata's 150 m^3 of daily sludge discharge to yield the remarkable benefit of zero solid waste from effluent treatment; in addition, the process generates biogas, which could be used as an energy source.

More immediately remarkable is the unexpected sight at the end of a short drive through the nearby maize fields: a large pond of tannery wastewater teeming with waterfowl (above). The natural science behind the miracle is the induced proliferation of *Spirulina* algae that thrive on what is left of the effluent pollution load after treatment. The wastewater is fed gradually from a smaller adjacent pond and soon becomes green, odourless and hospitable to fish, frogs and other aquatic life. A recent survey by a visiting ornithologist identified 21 species of waterbirds from ducks and herons to flamingos and fish eagles.

Ancient bushman art: Cave paintings by San hunter-gatherers and the earliest evidence of Zimbabwe's leather tradition. Photograph by Elfi Domes.

For more information about this project or UNIDO's Leather Programme in Eastern and Southern Africa, contact:

Eastern and Southern Africa Leather Industries Association (ESALIA),
P.O. Box 640, Village Market, Nairobi, Kenya. Tel: (+254 2) 446490/1.
Fax: (+254 2) 445344. E-mail: admin@esalia.org

Director, Agro-Industries and Sectoral Support Branch, UNIDO,
P.O. Box 300, A-1400 Vienna, Austria. Tel: (+43 1) 26026-3853/5109.
Fax: (+43 1) 26026-6849. E-mail: abenbrahim@unido.org

Published by the Leather Unit/Agro-Industries and Sectoral Support Branch of UNIDO under the project "Assistance in Tannery Pollution Control in Zimbabwe." Project manager: Aurelia Calabrò-Bellamoli. Technical advisor: Hans van Os.

Produced by Michael Domocos Consulting (MDC). Photography: Ian Murphy and MDC.