

ALTERNATIVE FUTURES FOR LATIN AMERICAN CITIES: A CASE OF STUDY IN TEPOTZOTLAN, MEXICO

Anibal FIGUEROA Ph.D¹
Carl STENITZ, Ph.D²
Gloria CASTORENA M.Arq.³

¹ Laboratorio de Arquitectura Bioclimática División de Ciencias y Artes para el Diseño, Universidad Autónoma Metropolitana, Av San Pablo 180, México D.F., 02200, México. fca@correo.azc.uam.mx

² Graduate School of Design, Harvard University, Gund Hall, 48 Quincy St., Cambridge, Ma.02138, USA

³ Laboratorio de Arquitectura Bioclimática División de Ciencias y Artes para el Diseño, Universidad Autónoma Metropolitana, Av San Pablo 180, México D.F., 02200, México. gmc@correo.azc.uam.mx

Keywords: latin american cities, sustainable planning, public transportation, bicycle roads, landscape management, water treatment, waste recycling.

Summary

The growth of large megalopolies in Latin America has created severe pressures on the physical and environmental systems. A strategic analysis of future alternatives for sustainable urban development on a mid term horizon can provide useful information and tools for authorities, non governmental organizations, academic institutions and general public.

We have chosen the municipality of Tepotzotlan, distant 40 kilometers from downtown Mexico City, because of its complex situation in the grow ring of the largest city in America and because it has important historic and environmental assets.

Environmental sustainability of the municipality marks the limit for many of the possible scenarios in terms of water supply, production cycles, land use, transportation, housing, etc. In collaboration with local authorities, social groups and two universities (UAM and Harvard) a new self sustainable development strategy has been proposed with emphasis in eco-tourism, regional economic development, traditional architecture, urban image and the rational use of energy and natural resources.

1. Project Frame

Our study has taken an academic approach to the problem within the structure of regular graduate courses at both Harvard and UAM universities. None the less, we have kept a direct and intense dialog with the main social and political actors so that our proposals have the possibility of being implemented.

It is the result of the combined efforts of a large group of people that included Jordi Barri, Modesto Bigas-Baledon, Kimberly Brigati, Patrick Curran, Renee Kaufman, Mitchel Keating, Chista Lee-Chuvala, Jose Lorenzo Torres, Liat Margolis, Barbara Pons Giner, Alexander Robinson, Ellen Schneider, Byron Stigge, William Trimble, Juan Carlos Vargas Moreno, Shiau Yun Lu, Javier Cruz Cuevas, Ingrid Santoyo, Valdemar Beltran, Jorge Ugalde, Ivan Cruz, Bernardo Sanchez, Aquiles Arreola, Angelica Cervantes, Rogelio Tobon, Anayeli Gutierrez, Felipe Temoltzi, Jorge Acosta, Claudina Arvizu, Daniel Gonzalez, Julieta Lagarde, Diana Perez and Gabriel Uribe among others . We formed an international multi disciplinary group to approach the project from different points of view that included design and social disciplines.

The three main axis of action have been: transportation, visual management and water and waste systems. All these issues have been analyzed at different scales and integrated into the projects. The actions proposed include four levels: regional trends, municipal action, regional projects and strategic buildings.

A large exhibit of the project has been opened to the general public at the national museum of in Tepotzotlan. Further analysis and specific actions for implementation related to the project are currently under study.

2. The Actual Situation

The municipality of Tepotzotlan is located in the northwestern grow ring of Mexico City's metropolitan area. It has a territory of 200 square kilometers with a total population of 80,000.

Environmental, economic, political and social pressures on the land are enormous, v.g. in the last four years 5,000 new housing units with an estimated population of 20,000 people were build across the river that is the political border with the neighboring municipality of Cuautitlan, less than 900 meters away from Tepetzotlan's downtown,.

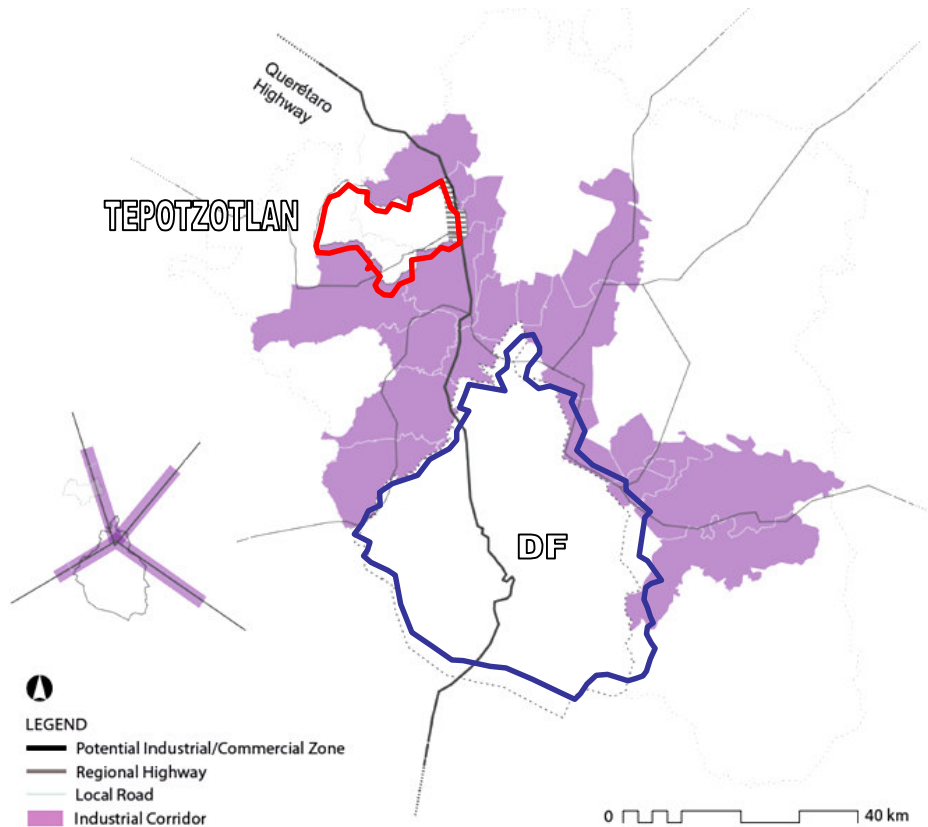


Figure 1 Tepetzotlan's location in reference to Mexico City's Metropolitan Area regional roads and industrial corridors.

2.1 Location

Tepetzotlan has a sensitive location in the growth ring of the Mexico City metropolitan area. Its territory is crossed by the Quereétaro Highway which is one of the major roads in Mexico connecting the northern territories with the capital.

2.2 Population trends

In 1960 its population was 13,000. It remained a quiet and picturesque farming town until 1964 when the highway was built. With communications, new population arrived as well as some industrial activity.

10 years later, in 1970, the population had almost doubled, reaching 22,000. At this point that the economy began to industrialize.

In 1985 a major earthquake hit downtown Mexico City, as a result of it the population move to the suburbs and Tepetzotlan count increased to 40,000 in the form of "informal housing" in an area known as Flores Magon. This meant that the downtown became more dense and that land adjacent to the highway quickly became industrialized

In 2000, the population reached 62,300. Tepetzotlan began to experience the ills of unregulated development: water shortages, traffic congestion, pollution of rivers and streams, and informal housing development and pressure coming from its southern and eastern borders where new high density housing have generated.

2.3 Historical Assets

The origins of the town can be found in the XIV century as a lake side town in the easiest entrance to the Valley of Mexico. However most of the historic monuments of Tepotzotlan date back to the XVI and XVII centuries when the Jesuits build a large monumental complex and a series of accessory chapels and secular buildings. From that period there are bridges, chapels, aqueducts and dams. The latter form a large and complex irrigation system that brought prosperity to the region.

Jesuits were expelled from America in 1790. But Tepotzotlan kept until mid XX th. century a series of well preserved haciendas and ranches producing high yields of vegetables and milk products. In the XIX century immigrants from Europe, particularly Germany and Italy established in the town, bringing new technology and prosperity to this fertile region.

In 1964 the main religious building was opened as the National Museum of the Viceroy Period, concentrating the largest collection of paintings and objects from the XVI to the XVIII centuries in the country.

2.4 Environmental Assets

The Hondo River crosses the municipality from west to east and defines its southern border. There are no water treatment plants and all sewage -industrial and domestic- goes to the river, polluting its waters.

The fertile land of the municipality remains now a days mainly agricultural. In 1977 the mountains that surround Tepotzotlan were declared Sierra de Tepotzotlan State Park. With a surface of 80 square kilometers, this park counts for nearly half of the municipality's surface. A wide variety of endemic vegetation, including fifteen varieties of quercus and a unique specie of orchid has been documented only on it.

Sewage and stormwater management are regional issues that impact Tepotzotlan significantly because regional sewage of Mexico City flows through the municipality in open channels. A buried combined storm – sewer runs directly under the municipality as well.

3. Main Study Systems

Three main study systems were analyzed: transportation, visual management and water and waste

3.1. Transportation

The current transportation network poses a number of challenges to the growth and quality of life of Tepotzotlan. Existing conditions such as the hundreds of speed bumps and limited public transportation options make moving through Tepotzotlan challenging. With only one main east-west road and one main north-south road, traffic is terrible and mobility is restricted.



Figure 3 Road Network System Plan

3.1.1 Transportation Improvements

We propose that significant investment be made in the improvement of the transportation infrastructure of Tepetzotlan. First a new southern parkway is constructed along the Rio Hondo. Second, a new northern road adjacent to the Sierra. Third, a new interchange with the Queretaro highway, third the development of a regional rail connection, fourth the development of an express bus route and fifth an alternative bicycle road net. A key concept in this network is the separation of different types of traffic. In its current state, the transportation network mixes bus, truck, car and bicycles travel on one road making it difficult and dangerous.

The southern parkway will be a four line road for trucks and cars, it will avoid the existing downtown areas to function as an express connection to the north and west zones. In some segments, it will run parallel to the Hondo River where pedestrian and bicycle roads will be provided.

The northern road parallel to the Sierra will have a rural character. It will be a two line road with limited access for cars only. It will become a limited development driver for the edge of the sierra projects and access road for tourism into the central zone.

A new interchange with the Queretaro Highway is important for the future northbound development associated to a urban subcenter located to the north of the main town. Here is where we plan most of the future medium density housing, commercial and services development will happen because this area has very poor soil, no irrigation systems and is easily accessible by the main highway.

3.1.2 Public Transportation

The sustainability of the plan is linked to public transportation instead of the use of cars. For that purpose an express route system is proposed connecting all the municipality in a circuit and linking it to a regional railroad system. It is clear that for people living in Tepetzotlan and having to travel to other areas of Metropolitan Mexico City a regional train connection will be more cost and time effective than any possible individual vehicle option.

The main existing road will be aimed for public transportation. Access posts will be established along the circuit to allow for raised access to the buses. This will avoid unauthorized stops or detours from established routes.

3.1.3 Bicycle Strategy

Finally a special emphasis has been taken into bicycles. Now a days Tepetzotlan's population has a limited income and the most popular individually owned transportation media is the bicycle. However its use is limited because it is extremely dangerous to share the same line with public transportation and heavy weight trucks. The distances (maximum 20 kilometers), linear form and topographical characteristics (following the river cause) make it simple and desirable to develop an independent bicycle net. We believe it will consolidate an existing tendency to use this vehicle that is by far the most efficient, economical and sustainable of all transportation media on a short distance range.

3.2. Visual Management

3.2.1 Visual Management Plan

Visual management is a fundamental tool on a sustainable approach. It does not relate only to the "picturesque" character of a site, but to its most significant natural and man-made assets. Visual Management is a key factor because it determines the "desirability" of land and therefore drives the value and cost variables. Because of its location and assets we believe that Tepetzotlan land can become one of the most desirable locations in northern Mexico City for middle to medium-high income housing.

The plan included an evaluation of the visual assets done by direct enquire to local residents and visitors ranking their value on a one to five scale. Based on these results a visual preference map was developed.

Then visual assets were weighted by their accessibility, understanding that a most preferred area that is inaccessible has less value than other less preferred but that is seen everyday by most people. This evaluation produced a visual access map.

Finally both maps combined produced a visual management plan. Five areas were identified for: Preservation, Retention, Partial Retention, Modification and Improvement.

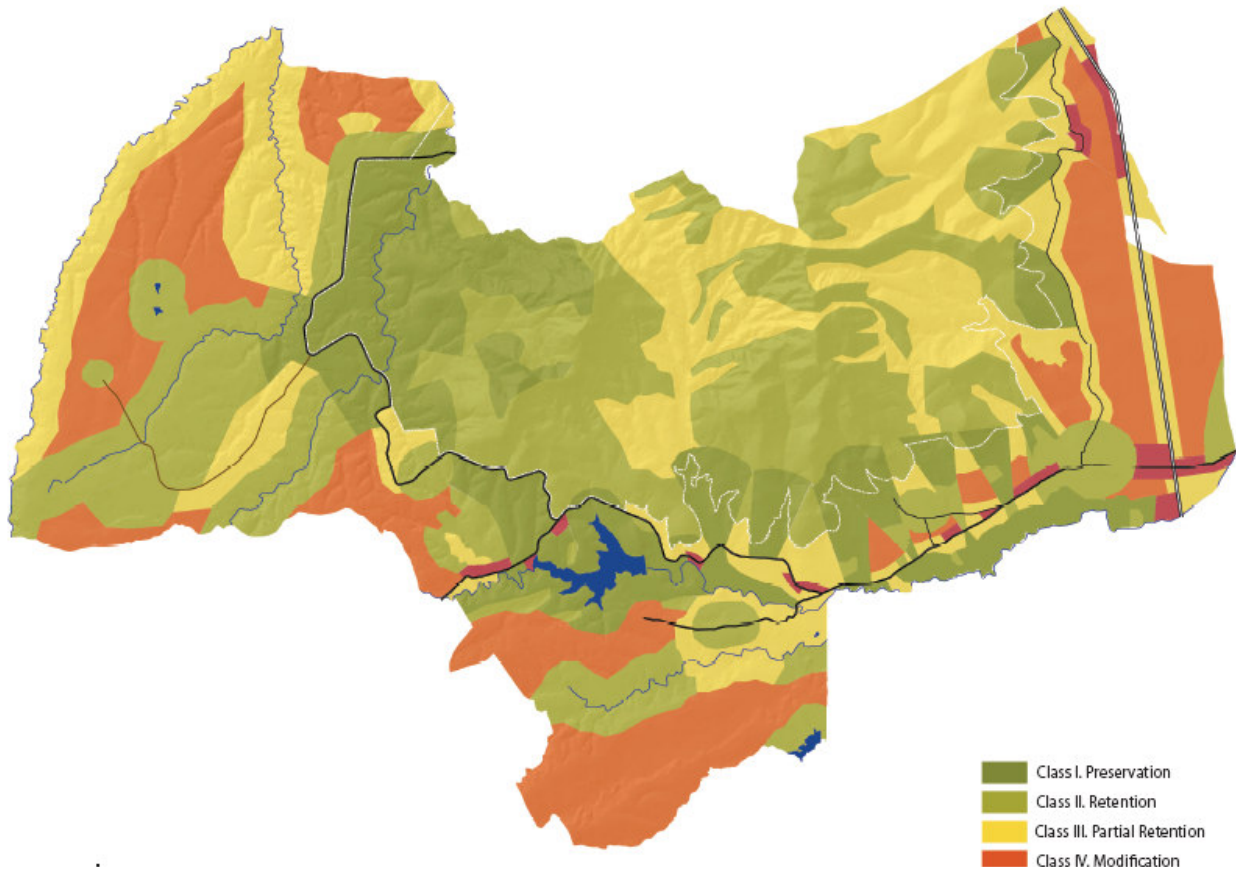


Figure 4 Visual Management Plan.

3.2.2 Green Corridor System

As a result of this strategy a “green corridor” system was developed. These areas were located in strategic points that allow spectacular views to the Sierra, have mature trees, differentiate the towns and are related directly with topography and water systems.

In Tepozotlan, as in many other parts of America, the existing villages date back to more than 500 years. They preserve a form of social organization related to cardinal points in four neighborhoods each villa. This form of organization gives character and social coherence to each villa. Therefore, it is important to preserve open space between the villas in the form of “green corridors”, so that they keep their identity, differentiating one from the other. We want to avoid a conurbation process where a uniform build coverage fills all the landscape.

3.2.3 Reforestation

Attached to the visual management plan a reforestation program was developed. Through the centuries, the natural landscape has been changed by man use and abuse. However, In 1987, part of the Sierra Area passed to the army’s control. They use this territory for practice and have done a large reforestation campaign. Based on this successful experience we consider a massive reforestation campaign can be carried out by the army, social and non profit organizations to increase the green cover of the sierra. This actions will produce employment, economic benefits and reduce erosion.

The strategy for reforestation is based on local species (quercus and pines) that have environmental and economic value. Two main existing nurseries can provide the large number of threes required: the army’s camp and Xochitla’s natural reserve.

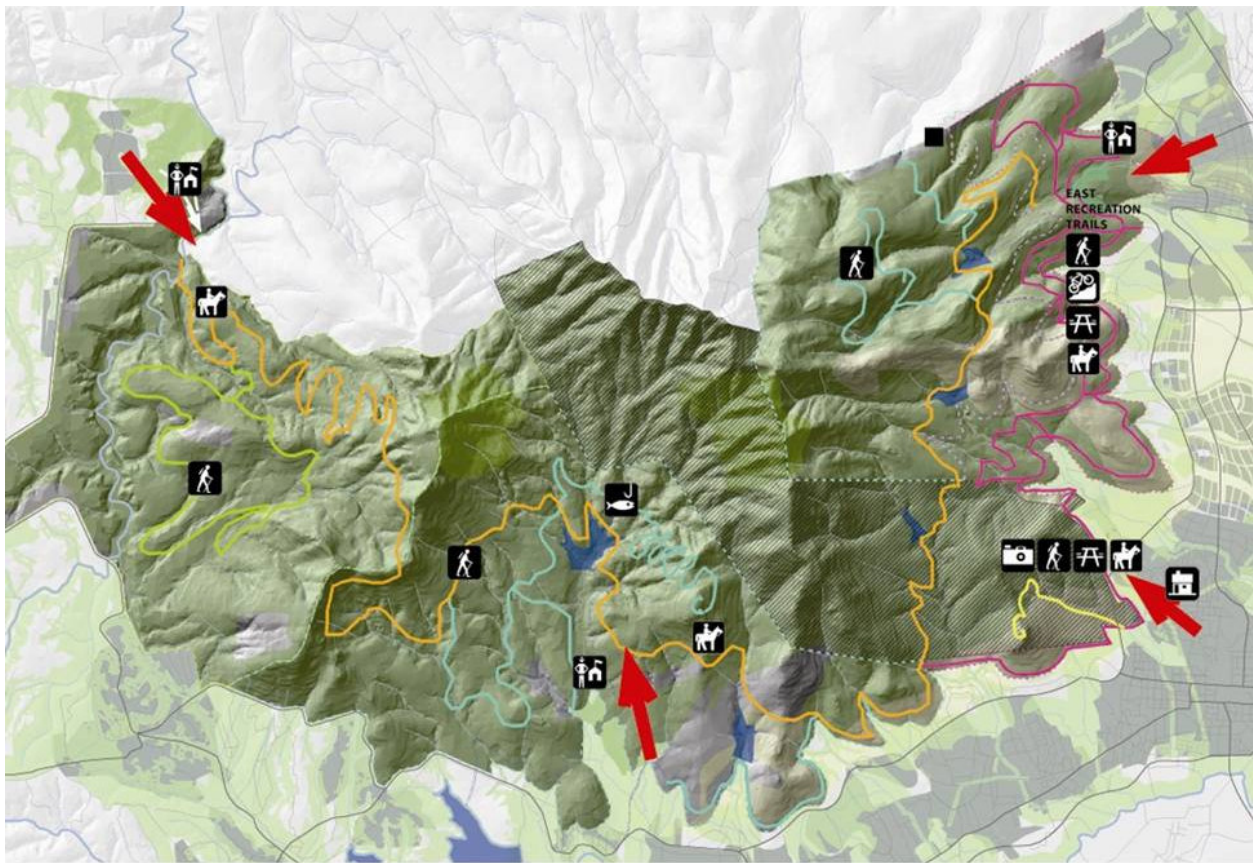


Figure 5 Sierra Management Plan Diagram.

3.2.4 Sierra Management Plan

A specific Sierra Management Plan was also developed with the aim of increasing its use and accessibility. Our approach is based on eco-tourism and organic agriculture. We believe that the Sierra can become a major tourist attraction to Mexico City's metropolitan area. Among the activities proposed are camping, horse riding, hiking, fishing and bird watching. Some areas will remain closed to the public for preservation purposes. An "edge of the park" master plan foresees the construction of research institutions, hotels and gated communities in order to form an effective access control barrier. Public access will be limited to four controlled gates.

3.3 Water and Waste Systems

Water and waste systems have been analyzed as a unit, because they can be complementary one from the other. They have been considered separately with a pivotal axis on a new recycling plant that is linked to the main highway.

3.3.1 Water Systems

The water system has been divided into: drinking water supply, waste water piping and treatment, waste water reuse and rain and storm water system.

Water is the fundamental element for sustainability. Now a days it is an unused asset of the municipality. Drinking water is obtain from 10 deep wells (all of them 100 meters or more). The underground water is physically linked to the Valle of Mexico water system. It has thousands of wells and increases constantly its dept. Due to water quality and long term availability this source of water was considered "not sustainable" and new alternatives were sought.

The sierra park land proved a valuable asset for drinking water. It is a self contained rain water basin for Tepotzotlan, this means that most rain water flows to the southern slope of it in the municipality's territory

with no human activity on its causeway. Therefore we consider the programmed construction of five water reservoirs in the highlands of the sierra. Due to its rainfall regime (880 mm per year) it is possible to substitute well water by rain water. Drinking water coming to the new reservoirs will require minimum treatment because its controlled basin. Reforestation and sierra management plan are linked to this proposal to reduce water sedimentation and provide additional tourist sites for fishing and hiking.

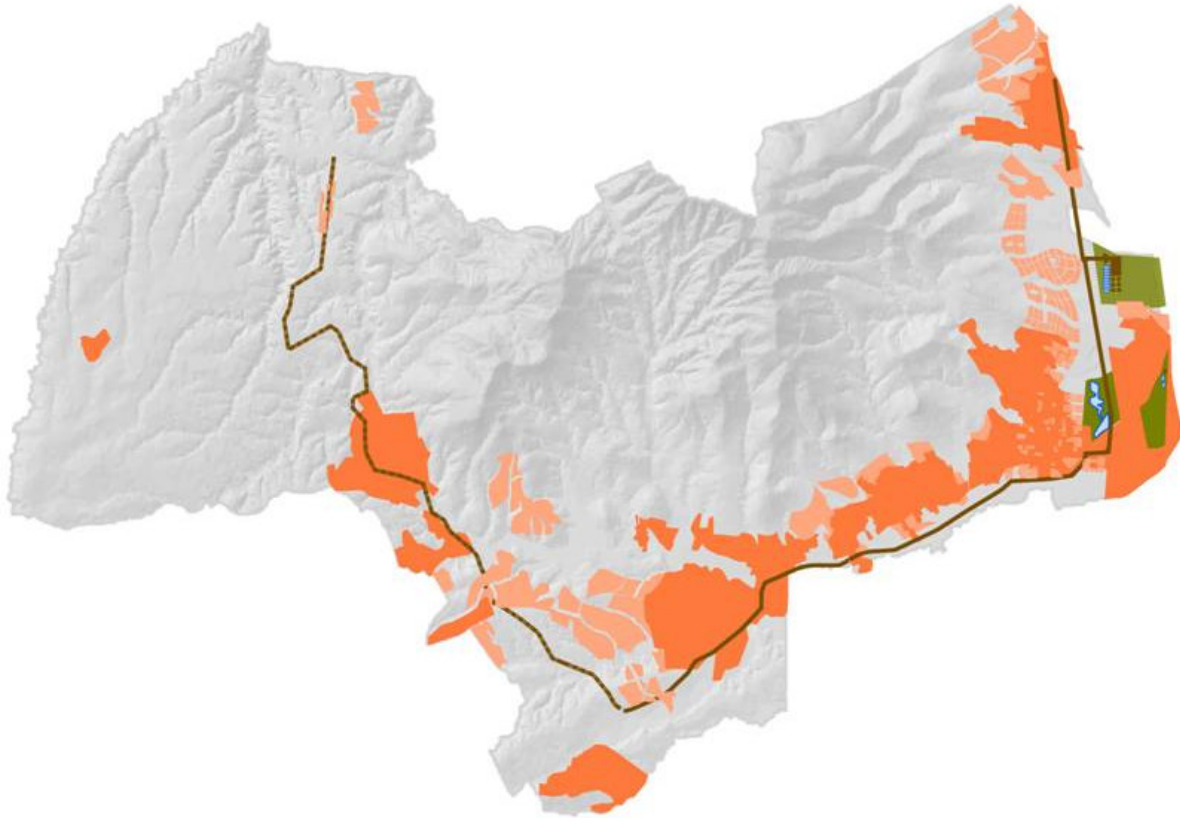


Figure 6 Proposed developed area, main sewer collector system and water treatment plants.

With no water treatment plants for waste water, the river and irrigation channels are used as open sewage network constituting a nuisance and health hazard for its population. We considered that there is an opportunity for a municipal large water treatment facility that can work with the local waste water and –if successfully managed- can even use the large amount of waste water coming from Mexico City's valley that passes by and under its territory.

A municipal sewer system has been planned on the existing road parallel to the river. It will collect all domestic and industrial waste water and conduct them to two water treatment plants near the highway and next to the industrial parks existing and planned. This way, used water will be available for industrial use before it is returned to the rivers after a final water treatment.

Independently a storm water system will be formed by the green corridors and the river. On flat tracks of the river causeway, wetlands will be formed to allow storm control and underground water recharge of non polluted unused rain water. At the same time, this storm water system will provide recreational use of the river and communication use of the causeways by pedestrians and bicycles on low cost, leveled and secure independent roads.

The river and the colonial era irrigation channels will run clean water that can be successfully used for profitable pesticide free crops and the flower production sustainable farming industries.

2.3.2 Waste Systems

Actually there is no waste recycling in the area. All debris from houses and industry go to an unmanaged open landfill site just north of downtown. The landfill is currently poorly located with respect to dominating winds, highway access and potential future development.

We plan to implement a waste recycling plan on a new site just east of the highway on the lowest part of the municipality. Its location is strategic, because recycling will be done by industry local and regional, only if it is

accessible and constant. This facility will combine water treatment with waste disposal and allows for recycling as well as energy production. All its production is needed and desirable for transforming industry located near by.

On a domestic level a new municipal policy needs to be implemented, separating waste by type at home and fixing days for each type of product.

These waste management techniques can transform solid waste from an unsanitary, unsafe and unsightly practice into an safe and clean income source for the local government.

4. Conclusions

Mexico City has a well deserved reputation of being one of the largest and most difficult urban areas in the world. It has been grown and developed by "market driven" forces rather than by reason and logical patterns. It is clearly "non sustainable" as it depends and deprives all neighboring valleys and regions of its resources including water and energy.

We have briefly described the main elements of our plan: transportation, landscape management and water and waste systems. If successfully implemented, they can allow the municipality of Tepotzotlan to become the first self sustainable municipality in Mexico City's Metropolitan Area.

Tepotzotlan, with its cultural, historical and environmental conditions, can determine a changing point for the future development of communities on the edge of large metropolitan areas. We have planned for a rational growth regional strategy that can be complemented by high efficiency local building ordinances.

Our project has tried as hard as possible to remain within the feasible limits, with social values and opinions in all its process. It has already generated a large discussion on the community and has attracted the interest of the press and politicians.

We believe that the three general axis of this study, combined with other regional and key projects that form part of the full study, can alter in a positive way the destiny of Tepotzotlan and increase significantly the quality of life of its inhabitants.

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