Los Llanos and Scenario Planning

Los Llanos is a growing community in the Monteverde District which is part of the Puntarenas Province. It is located southwest of Santa Elena along the main road connecting Monteverde to the Pan American Highway. Los Llanos, like the rest of Monteverde, has been experiencing significant population growth and physical development. Much of this growth is due to the booming tourism industry in the Monteverde region. Los Llanos’ proximity to Santa Elena, its relatively flat terrain and inexpensive land, make it the likely location for continued growth. Compared to Santa Elena, Los Llanos is relatively undeveloped. This gives the community a great opportunity to guide future development in ways that are more beneficial and less harmful to the community. (see Los Llanos neighborhood map)

This study is meant to help the Los Llanos community, including its residents, institutions, and businesses, better plan for future growth. Background research was conducted in Los Llanos in order to better understand past and present trends. This background research describes recent development patterns, including physical, social, and economic development, in Los Llanos. Important characteristics of infrastructure, mobility, waste and water management, population, and natural resources are described background analysis section of this report. This report describes three scenarios that represent alternative futures for Los Llanos. These scenarios include a business as usual scenario, conservation and compact development scenario, and an economic diversifications scenario. These scenarios can help generate discussion and ideas in the Los Llanos community about how to achieve common goals.
This scenario planning project builds upon past scenario planning projects in the Monteverde Zone. This project in Los Llanos was conducted concurrently with scenario planning in Santa Elena, and many of the pieces of the three alternative Los Llanos scenarios were developed along with possible scenarios for Santa Elena.

Background Analysis of in Los Llanos

Natural Resources

The natural resources of Los Llanos are part of a larger ecosystem in Monteverde. These natural resources provide for people and the flora and fauna that live in Monteverde. This section details the methods and results of the land cover analysis including slopes, watershed, and reserves comprising the Los Llanos community. A detailed discussion of the natural resource for the Monteverde region as a whole can be found in Section X of this report.

Mapping Methodology

Land cover was delineated within the Los Llanos study area based on the 2005 aerial photograph, in conjunction with field surveys whose purpose was to provide a level of ground-truthing to ensure the relative accuracy of the created data set. Prior to conducting the field surveys and creating the data set, four general categories of land cover were identified – pasture, forest, urban, and windbreak. Note that due to limited property access, field surveys were limited to line-of-sight for individual surveys from the public roads in Los Llanos.

Following completion of the fieldwork, a GIS was used to delineate the boundaries between land cover types within the study area. Individual polygons were created at a scale approximating 1:5000 meters as this level of detail allowed for finer scale adjustments without compromising image resolution. The classification of land cover types for areas not available for field surveys was based on the classification applied to similar areas for which field surveys were conducted.

Slopes within the Los Llanos study area were identified following a slope analysis using the ArcView 3-D Modeling tool as part of ArcMAP. After acquiring a vector-based elevational data set, ArcView was used to create a triangulated irregular network (TIN) representing the three-dimensional surface of the study area. From this data set the slopes within the study area were extracted.

The major watersheds comprising Los Llanos were delineated based on the aforementioned vector-based elevational data set. This data set provided contours demarcating the elevation every 20 meters. Finally, reserves were identified on hard copy maps and entered into a GIS data set based on the parcel boundary GIS data set provided to the Sustainable Futures students.

Results

As is depicted in Figure XX, the results of the land cover mapping for Los Llanos indicate that approximately 60 percent (263 hectare) of the study area was forested in 2005. The second most expansive cover type was pasture, comprising approximately 135 hectares, or 31 percent of the Los Llanos community as previously defined for this report. While no distinction was made between the type and age of forests within the study area, this data provides valu-
able information regarding overall forest cover in the area. Additionally, only one preserve exists within the study area – the Bellbird Preserve – and covers approximately XX hectares.

Los Llanos Land Cover 2007

<table>
<thead>
<tr>
<th>Area (hectares)</th>
<th>Percent Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developed</td>
<td>27.7</td>
</tr>
<tr>
<td>Forest</td>
<td>263.3</td>
</tr>
<tr>
<td>Wind Break</td>
<td>7.3</td>
</tr>
<tr>
<td>Pasture</td>
<td>134.6</td>
</tr>
<tr>
<td>Total</td>
<td>432.9</td>
</tr>
</tbody>
</table>

Much of Los Llanos is relatively flat and suitable for future development (see Figure XX). Two major watershed were also identified – the Rio Lagarto watershed and the Rio Guacimal watershed (Figure XX). Most of the study are, however, is located within the Rio Lagarto watershed as the ridge delineating the two flows the main road between Monteverde and Puntarenas.

Development Patterns

In order for a community to plan for the future, it needs to understand where it has come from and where it is currently. Understanding past and current development patterns in Los Llanos will help determine what might develop in Los Llanos in the future. This section describes these development patterns.
Methodology

Maps were created using Environmental Systems Research Institute, Inc. (ESRI) ArcView geographic information system (GIS) software to compare development in Los Llanos from 2003 to 2007. The 2003 and 2005 aerials of Monteverde were used to create a road map of Los Llanos as well as 2003 and 2005 existing structure maps. The road maps and structure maps were verified with onsite surveys conducted by several students at the Monteverde Institute during two days of field work in 2007. The 2007 structure map was also created during these surveys. Each 2007 structure was also categorized by type (show type table) based upon visual inspection. Additionally, the 2003 and 2005 structures were categorized by type as it was assumed that structure types in 2007 were the same in 2003 and 2005. The 2003 and 2005 structure inventories were limited by the quality of the aerial photos used.

Findings

Los Llanos realized a significant amount of growth between 2003 and 2007 (see Figure XX). This growth is likely the result of three factors – its location along the main road between Monteverde and Punterenas, its direct adjacency to Santa Elena, and its relatively level topography.

The total number of structures in Los Llanos in 2003 was 217. In 2005 there were 276 structures and in 2007 there were 408 structures (including those under construction). Accordingly, Los Llanos realized 191 new structures between 2003 and 2007. There was more development between 2005 and 2007 than there was between 2003 and 2005, suggesting that the pace of growth is increasing. Table XX provides data on structures by year.

Los Llanos Development 2003-2007

<table>
<thead>
<tr>
<th></th>
<th>Total Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>217</td>
</tr>
<tr>
<td>2005</td>
<td>276</td>
</tr>
<tr>
<td>2007</td>
<td>408</td>
</tr>
</tbody>
</table>

The majority of the structures in Los Llanos in all three years were residential structures. In 2007, 324 of the 408 structures (79 percent) were residential. Only four of these structures were apartments, comprising 20 housing units. There were seven structures with mixed uses (typically a small store with an attached housing unit). There were 347 housing units including all residential structures, apartments, and mixed use structures. Less than 1 percent of the structures were institutional (the school) and less than 5 percent were classified as other. The relative proportions of structure types in Los Llanos in 2003 and 2005 were similar to those proportions in 2007. The neighborhoods in Los Llanos generally comprised a mix of each type of use.

Los Llanos Structure Types 2007

<table>
<thead>
<tr>
<th></th>
<th>Total Structures</th>
<th>Percentage of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>324</td>
<td>79.4%</td>
</tr>
<tr>
<td>Commercial</td>
<td>62</td>
<td>15.2%</td>
</tr>
<tr>
<td>Institutions</td>
<td>3</td>
<td>0.7%</td>
</tr>
<tr>
<td>Mixed</td>
<td>7</td>
<td>1.7%</td>
</tr>
<tr>
<td>Construction</td>
<td>10</td>
<td>2.5%</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>0.5%</td>
</tr>
<tr>
<td>Total</td>
<td>408</td>
<td></td>
</tr>
</tbody>
</table>

There were 62 commercial structures in Los Llanos. Most commercial structures were located near Santa Elena. Most of these structures were tourism related. Additionally, almost 88 percent of commercial buildings constructed between 2003 and 2007 were considered tourism related. A survey of businesses also revealed characteristics relating to the economy of
Los Llanos. Fifty businesses were identified in Los Llanos, which were further subdivided into two categories – (1) local businesses not related to tourism and (2) tourism related businesses. Of those 50 businesses, 23 were considered local businesses not related to tourism such as mechanics and local stores. The remaining 27 businesses (54 percent) were considered tourism based businesses. Based on these characteristics it is safe to conclude that the economy of Los Llanos is heavily based on tourism.

**Construction**

The information collected on construction permits in Monteverde details the amount and type of construction that has taken place in recent years.

**Methodology**

To estimate the amount of new development in Los Llanos, records of building permits granted by the municipality in years 2003 through 2007 were collected and analyzed. This data includes all new construction and annexations for the entire Monteverde district. While this data is not specific to Los Llanos, it provided general growth curves that can be applied to our study area. Construction permit was acquired from Municipality records electronically on June 18, 2007.

Each permit record was categorized into four building types – residential, commercial, tourist, and government/education. Residential building types included any descriptions of living quarters, homes, housing additions, and small garages. Commercial buildings include restaurants, office buildings, local shops, storage space, and any other local economic activities. Tourist buildings include all commercial businesses used specifically for tourism, such as hotels, cabins, tourist attraction offices and facilities, and other visitor information and lodging centers. Finally, the government/education category comprises all institutional buildings and additions for schools, infrastructure facilities and maintenance, and public research and service centers.

The total area of each new construction type was calculated for each year. This illustrates the amount of new area of each building type that was added to Monteverde for each year.

**Findings**

Permit data was analyzed both in total area and in number of permits granted. Graphs were created to illustrate growth of the different construction types over time.

Over the five year period, construction area peaked in 2005 at 14445.9 square meters. Residential construction was consistent over all five years. Tourism grew significantly from 2003 to 2005, and claimed the largest overall construction area in 2005. However, since 2005, tourism construction has greatly decreased. There has also been a steady increase in construction for commercial use over the five year period.

Like the area data, total number of permits granted also peaked in 2005. In all five years, the most permits were granted for residential construction. The number of permits remained relatively consistent for the three other construction types.
A study of existing traffic was conducted in the Los Llanos area to determine the impact of increased development on traffic in Los Llanos. The study identified the peak flows and direction of traffic, traffic composition, and its origin.

Traffic counts were conducted at three locations in Los Llanos – (1) the former toll booth on the main road from Puntarenas, (2) adjacent to the cemetery, and (3) immediately south of the Los Llanos elementary school along the main road from Puntarenas (see Figure XX). The counts occurred on two different days (Thursday, June XX and Monday, June XX, 2007) at three different time periods – 7 AM, 12 PM, and 5 PM – for 30 minutes each. Data was collected by pairs of students at each location, documenting both the type and direction of traffic.

The cemetery was chosen to capture the traffic flow that is likely originating from the nearby residential area. The toll booth location captured traffic coming from neighborhoods along the main road that also leads to the Pan-American Highway. The school was chosen because of its location outside of Los Llanos but on the way to the Pan-American Highway, thus acting as a control variable to determine if traffic is originated locally or from outside the region. The traffic passing the location of the toll booth includes both local traffic and traffic coming from the Pan-American Highway. The traffic passing the school is traffic that is coming and going from beyond Los Llanos and is thus outside traffic. Therefore the traffic at the toll booth less the traffic counted at the school can be assumed to be local in origin. In other words, the school location allows for the separation of locally generated traffic and traffic that is coming from outside the area.
**Conclusions**

The following conclusions are based on the results of the traffic counts. In all three locations the majority of traffic flowed toward Santa Elena in the morning and away from Santa Elena in the evening. For all three locations, counts conducted on Monday realized greater volumes of traffic than those conducted on Thursday. The toll booth realized the highest traffic volumes with an average of 24.2 incidents of traffic per half hour. The cemetery had the second highest traffic count with an average 21 incidents of traffic per half hour, while the school saw much less traffic overall (10.5 traffic incidents per half hour). These results indicate that most traffic in Los Llanos is local in origin. All averages calculated here are include count data from all three time periods for both Thursday and Monday.

Traffic composition varied greatly as depicted in Figure XX. In general there was more pedestrian traffic at the two locations closer to Santa Elena and more vehicular traffic at the location that leads directly to the Pan-American Highway.
Waste and Water Management

Waste and water management are important issues for any community. Both are needs that can be costly. The need for waste and water management can sometimes be met by local government, and sometimes dealt with individually. Poor management of both of these topics can put the health of the local population at risk and deteriorate regional ecosystems.

Solid Waste Management

The management of solid household waste in Los Llanos was examined using data gathered from the Clinica de Monteverde. It must be noted that the Clinic’s data is based on a boundary of Los Llanos that differs from the boundary identified for this project. Based on the data originally collected by the Clinic, 217 detached dwelling units exist within the Los Llanos community; however, only 200 were available for questioning. Based on data collected during 2006, 155 homes (77.5 percent) utilize the public collection system that picks up garbage twice weekly. It is presumed that the ultimate destination for this trash is a dumping ground near San Jose, where most of the country’s trash is deposited. Seven houses (3.5 percent) bury their garbage as a means of management, while the remaining 38 homes (19.0 percent) burn their solid waste. It is expected that with increasing municipal capacity and the paving of roads in Los Llanos, more households will subscribe to the public waste system as a means of dealing with their garbage.

<table>
<thead>
<tr>
<th>Households</th>
<th>Percentage of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Collection</td>
<td>155</td>
</tr>
<tr>
<td>Bury Trash</td>
<td>7</td>
</tr>
<tr>
<td>Burn Trash</td>
<td>38</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
</tr>
</tbody>
</table>

Data Source: Monteverde Health Clinic

Water Supply

Access to potable water is a crucial issue in Los Llanos. This may be surprising given the amount of rain in the area. However, existing fresh water infrastructure is becoming overwhelmed by increased demand. Increased demand is coming from both residential and commercial growth in Los Llanos and the surrounding community. There may soon be plans to expand AyA infrastructure to include additional facilities in Los Llanos to supply water.

The vast majority of homes, 179 houses (89.5 percent), are supplied their water by the national AyA water service. A remaining 21 houses (10.5 percent) receive their water by either private springs or wells. Using well water makes water contamination a more important issue in Los Llanos.

<table>
<thead>
<tr>
<th>Households</th>
<th>Percentage of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>AYA Water</td>
<td>179</td>
</tr>
<tr>
<td>Private Water</td>
<td>21</td>
</tr>
<tr>
<td>No Indoor Plumbing</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
</tr>
</tbody>
</table>

Data Source: Monteverde Health Clinic
Water Treatment

Waste water is mostly treated privately with on site septic systems in Los Llanos. Homes using septic systems account for 195 homes (97.5 percent). One hundred-ninety (95 percent) of those houses have functioning systems, while a remaining 5 houses (2.5 percent) have failing systems. Of the 200 total houses surveyed, a minority of 5 houses (2.5 percent) are utilizing self-made outhouses. While most of the black water in Los Llanos is currently being treated in an acceptable way (based on local Zone standards), more could be done to ensure safer black water treatment on a regional level. It’s been rumored that the municipality is in the midst of negotiations with El Banco National to allocate funds for the creation of a regional wide water treatment plant. Plans for this have yet to be finalized or secured and the exact location of a possible treatment center is still unknown. A plant, if constructed, is most likely to occur within the Los Llanos area for reasons of regional topography; Los Llanos is relatively lower than the rest of the Zone, and can thus harness the forces of gravity.

No data currently exists regarding grey water treatment in the area. In Los Llanos, as in the rest of the Monteverde region, grey water is likely pumped out onto the street or behind houses without any form of processing. While green management solutions exist (e.g., reed beds), cultural acceptance of such practices does not currently exist. Most likely, grey water will be treated with household black water if and when a regional-wide water treatment system is put into place.

Population

This section describes the characteristics of the people living in Los Llanos. It also describes how that population has grown in recent years.

Methodology for Measuring Population

Two separate methodologies were used for measuring the population of Los Llanos. One method was based upon 2006 Clinica de Monteverde data that measured population for all of Monteverde and its individual communities, including Los Llanos. The health clinic data included many categories of information about the population and housing as well as total population.

The second method used the number of existing residential housing units as detailed above. This method was used to determine the population of Los Llanos in 2003, 2005, and 2007. The 2006 Health Clinic data revealed that an average of 3.68 people live in each housing unit in Los Llanos. Thus, the second method multiplied the number of housing units in Los Llanos by 3.68 to determine the 2003, 2005, and 2007 populations.

As noted above, the Clinica de Monteverde and this Sustainable Futures scenario plan-
ning report used two separate boundaries to delineate Los Llanos, which has resulted in different estimates of population totals. The Sustainable Futures boundary of Los Llanos included portions of Santa Elena adjacent to the cemetery in Los Llanos as this area is considered the gateway to Los Llanos. The Clinica de Monteverde excluded this area from data collection for Los Llanos.

**Population Characteristics**

Based on data collected by the Clinica de Monteverde for 2006, there were 3,728 people living in the Monteverde District. Slightly more than 20 percent, or 751 people, lived in Los Llanos. The population of Los Llanos is generally young. Of the total population, 436 people, or 58 percent, are under 25 years of age. Additionally, slightly more than half of the population, or 388 people (52 percent), were female. See tablexxx

Data collected by the Clinica de Monteverde also indicates there were high literacy rates in Los Llanos in 2006. Of 631 people that were 7 years or older in age, only 15, or 2.4 percent, were illiterate. The majority of the people that were illiterate were 35 years or older in age (see Table XX).

Of the 200 families from which the Clinica de Monteverde collected data, 43 families, more than 21 percent, were female headed families. This is likely due to concentrations of government subsidized housing for female headed families in Los Llanos. Only 3 of the 200 families were at or below the poverty line. Table

Homeownership in Los Llanos is common. Of the 200 families with whom data was collected in Los Llanos, 163 families owned their own homes, 31 families rented their homes, and 6 families borrowed their home. Table

Based on data collected by the Clinica de Monteverde, the composition of the labor force for Los Llanos is reflective of that for the region as a whole (see Figure XX). In 2006, nearly half of the people in Los Llanos and the District of Monteverde were employed full time. Nearly a quarter of the population of both areas were students, less than 8 percent were employed part time, less than 20 percent worked at home, and 3 percent or less were retired and unemployed.

**Population Growth**

Using the method developed by the Sustainable Futures students, the population of Los Llanos appears to have increased substantially between 2003 and 2007 (see Table XX). In 2003 there were 666 people living in Los Llanos. In 2005 there were 865 people and in 2007 there were approximately 1,277 people living in Los Llanos.

As previously noted, the population of Los Llanos is concentrated in a few distinct neighborhoods. Population distribution maps for 2003, 2005, and 2007 show that population density in these neighborhoods increased substantially over this time span, while other areas remained unaffected (see Figure XX)
Alternative Scenarios

Purpose of Scenarios

Los Llanos is likely to be rapidly developed over the next few decades. As Santa Elena becomes built out, development will continue to push south into Los Llanos. The land in Los Llanos is relatively inexpensive, flat, and located along the main road between Puntarenas, the Pan American Highway, and Monteverde. These factors will lead to future growth including population, physical development, and economic development.

Each scenario described below is based on the same projected population growth and the same need for housing based on that population growth. Each scenario also assumes that the workforce in Los Llanos will continue to grow with population growth. Immigration and a young population that will age and be part of the workforce will create this growth. A larger workforce will require more jobs than currently exist today. All scenarios include a new church near the Cemetery in Barrio Orquideas, although other alternatives are still being discussed.

Each scenario describes alternative and distinct possibilities for future physical development, economic development, waste and water management, transportation and mobility, natural resources, and the future demand for institutions designed to meet these needs. The current year 2007 is used as a base for each scenario, and the years 2020 and 2030 are used as reference points to demonstrate future possibilities.

The Business-As-Usual scenario reveals what Los Llanos will look like if present trends, or minor variations on those trends, continue into the future. The Conservation scenario demonstrates what Los Llanos will look like if future development is guided by the principles of environmental conservation. The Economic Diversification scenario illustrates what Los Llanos will look like if the economy is not focused solely on tourism, but diversifies to create a stronger, more vibrant local economy.

Population and Housing Projections

Population and development projections were used as the basis for the three alternative future scenarios for Los Llanos.

Methodology

Population projections for Los Llanos were based on the estimated 2007 population of Los Llanos. Using a 5 percent annual population growth rate, population was estimated in Los Llanos for every year between 2007 and 2030. Past scenario planning projects used a 7 percent growth rate, but information from meetings with Monteverde officials suggest that population growth will slow as tourism development slows and as families are having fewer children.

Projections for housing development were based on the 2006 Clinica de Monteverde average household size data for Los Llanos and the estimated population for each year. This data suggests that an average of 3.7 people lived in each housing unit in Los Llanos in 2006. The population totals for each projected year were divided by 3.7, resulting in the estimated need for housing units in Los Llanos.

Each of the three scenarios use 2020 and 2030 as focal points to demonstrate and compare the impacts of each. Potential fluctuations in growth in Los Llanos may increase population faster or slower than projected. However, the projected population growth will take
place at some time in the future and the scenarios are meant to demonstrate what this growth might look like in Los Llanos depending on what decisions are or are not made.

**Projections**

In 2007 there were an estimated 1,277 people living in Los Llanos in 347 housing units. The population is estimated to double by 2020, only 13 years from 2007, to a total of 2,408 people. This would create the need for 651 total housing units, 314 more housing units than in 2007. By 2030, the population is estimated to triple to a total of 3,922 people. This population growth would create the need for 1,060 housing units, or 713 more housing units than in 2007.

**Assumptions**

Several assumptions were used to generate each of the three scenarios. The growth of population and the need for housing is the same for each scenario. The need for new services, such as schools and other infrastructure, will also be considered in each scenario. It is also assumed that tourism will continue to be a major part of the Los Llanos economy into the future.

**Scenario 1: Business as Usual**

**Physical Development**

Recent development patterns in Los Llanos, especially in the last decade, have been uncoordinated. This has resulted in sporadic and disconnected development. Strip development is occurring along the main road in Los Llanos. The resulting urban form is one that is sprawling and lacking open space. Existing land use regulations have not been enforced. A list of relevant land use regulations can be found in Jason’s Report.

As the value of land close to Santa Elena continues to increase, residential development will be pushed further south into Los Llanos. If these development trends continue, landowners are likely to sell off portions of land for residential subdivisions. Few alternative types of housing will exist for an increasingly diverse population of residents.

Commercial development is likely to take place along main roads where higher property values are realized. Strip commercial development is dominated by parking lots. This type of development eliminates the possible formation of vibrant urban centers.

Figures XX through XX illustrate examples of how business as usual development may progress from 2007 to 2030.

**Natural Resources**

Much of Los Llanos has been untouched by urban development. However, as low density urban development spreads sporadically throughout area, forests and pastures will become buildings, roads, and parking lots. Steep slopes in Los Llanos may be built on as flat land becomes more expensive. Erosion, wastewater, and runoff from increasing amounts of impervious surface will degrade water in the streams surrounding Los Llanos, and ultimately

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
<th>Housing Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>1277</td>
<td>347</td>
</tr>
<tr>
<td>2020</td>
<td>2408</td>
<td>651</td>
</tr>
<tr>
<td>2030</td>
<td>3922</td>
<td>1060</td>
</tr>
</tbody>
</table>
the Rio Guacimal and Rio Lagarto, negatively impacting downstream communities. Views of mountains and valleys will be lost as development privatizes areas with views, thus blocking the views from the public. Light from development, traffic, and roads will blanket the community and block out stars in the night sky.

Biological corridors connecting the Rio Guacimal and Rio Lagarto watersheds will be lost as development replaces open space. Roads without connecting canopies will further reduce the ability of animals to cross through Los Llanos. This could reduce the populations of critical species in Los Llanos, including the Bell Bird. This would have an overall negative impact on the economy of the region due to its heavy reliance on eco-tourism.

**Mobility**

Increased physical development, both residential and commercial, and an increased population will create more traffic in Los Llanos. A low density, dispersed development style will make the use of automobiles more necessary because distances between land uses will be greater.

An investment in automobile friendly infrastructure, rather than pedestrian infrastructure, will benefit only the few people in Los Llanos who own cars. Paved roads will increase automobile traffic by making it easier for cars to move around and more dangerous for pedestrians or bicyclists. Paved roads may also increase tourism related traffic in Los Llanos, as it may be faster for buses and cars to get to Los Llanos and Monteverde from the Pan American highway.

This increased traffic will have detrimental affects on the community. It will deteriorate air quality, create noise, and create safety and health problems for local residents and tourists. Unplanned and unconnected roads will lead to traffic problems in many of the neighborhoods in Los Llanos, making those neighborhoods less livable. As congestion increases, the quality of life and quality of the experience in Los Llanos will worsen.

**Waste and Water Management**

*Solid Waste Management* – As population increases in Los Llanos, the amount of waste produced will also increase. Most of this waste is likely to be collected and shipped to landfills in Puntarenas. Recent discussions within the Monteverde community have suggested that Los Llanos may be an ideal location for new recycling transfer station. This transfer station, whether it is located in Los Llanos or somewhere else in Monteverde, will help reduce the total waste flow out of Los Llanos. However, it is possible that Los Llanos, like much of Monteverde, may have lost the culture of recycling. Without efforts to promote recycling, it may be unsuccessful at reducing waste.

*Water Supply* – The Los Llanos community has struggled recently with the supply of and access to potable water. If there is to be future development in Los Llanos, these problems will have to be solved. If past solutions are used in the future, AYA will have to expend the system of water collector tanks, pumps, and pipes, in order to feed Los Llanos. This will be very costly, and problems will continue to arise repeatedly as growth continues. As current patterns of development will likely result in sprawling future landforms, the cost and difficulty of providing potable water could increase dramatically.

*Water Treatment* – In Los Llanos, like the rest of Monteverde, black and grey water are
treated separately. Currently, black water is treated with individual septic systems which require space to be used effectively. This will reduce possible development densities in the future. Grey water treatment regulations are ignored more often than not. These treatment systems, or lack there of, will continue to cause water contamination problems at an increased level with future development.

The creation of a municipal sewage treatment plant in Los Llanos has been discussed. This is an alternative but incredibly costly solution. A network of sewers will have to be built throughout the Monteverde zone connecting each building to the treatment plant. Low density development in places like Los Llanos will increase the amount of sewers needed, and the resulting cost. Combining grey water and black water in this treatment system will eliminate the opportunity for alternative, inexpensive, and better waste water treatment solutions in Los Llanos.

**Public Services**

Schools in Los Llanos will be greatly affected by increased population growth. The school in Los Llanos is already at capacity, and has little or no land surrounding it to expand. It will be necessary to construct a new school for the growing population, and this new school will likely be built where land is cheapest. This will prevent the school from being in a more central location near residents, and will lead to further sprawling development. Coupled with the increased traffic associated with this development scenario, children will be in even greater danger when walking to and from school.

There will be little or no public green space in the future if actions aren’t taken to protect it now. Urban development will consume land without considerations of maintaining plazas, small parks, or other green spaces. This will eliminate the possibility of creating recreational opportunities, passive and active, for local residents including children.

**Economy**

The economy of Los Llanos, neighboring Santa Elena, and the rest of Monteverde, has shifted heavily towards eco-tourism. This same ecotourism is likely to drive development in the future. However, unless there are actions taken by local residents, members of local institutions, local business owners, and developers, the current form of development may hurt the eco-tourism economy. Increased unplanned urbanization, the loss of open space, and environmental degradation, will hurt the tourist experience. This could lead to a decline in tourism. Additionally, the loss of natural areas, particularly forests, will cause local species declines, which will result in fewer tourists.

It is also possible that tourism infrastructure, including businesses geared at tourists, will be overbuilt. Locally owned businesses will be harmed, and outside ownership of new businesses will take more money out of Los Llanos and Monteverde, resulting in further economic decline in the local population. Paved roads will increase the number of day trippers, but decrease the number of people staying for longer times, which result in less local spending. If tourism remains the sole economic driver and dairy continues to move further away from Los Llanos, increased unemployment and poverty may result in Los Llanos.
Scenario 2: Conservation/Compact Development

Physical Development

Compact development styles that promote vibrant urban centers and quality communities can be used in Los Llanos to improve overall quality of life. High density residential development already exists in some places in Los Llanos, including the La Colina neighborhood (show photo). This type of development can be used and improved upon for future residential neighborhoods in Los Llanos. By building homes close together yet preserving green space in the center of residential blocks, higher densities can be achieved and public open space can be preserved. Different housing styles can also be built, including rental apartment buildings, to provide for a variety of housing needs, including young families, students, and workers. Apartment-style buildings could be less than three stories tall, and still provide quality living places.

Commercial development can be centralized within these neighborhoods, creating vibrant urban areas and public spaces that promote pedestrian activity. Using denser buildings that mix uses, including commercial and residential space, urban areas can become more vibrant, and existing open space can remain undeveloped. Using shared parking lots reduces the need for more increased amounts of impervious surfaces, subsequently reducing run-off and improving local water quality.

Existing land use regulations will need to be enforced. New land use regulations will promote this type of dense development, with public open spaces, to preserve large tracts of existing and new open space and natural areas.

Figures X through X depict examples of how conservation development may progress from 2007 to 2030.

Natural Resources

Higher density buildings, and more compact neighborhoods, allow open space to be preserved. Large tracts of land can remain undeveloped, and public green space within developed areas can provide this open space. Forests provide many environmental services. Trees clean air and water, reduce wind, maintain comfortable temperatures, reduce erosion, and provide habitat which maintains biodiversity. Preserved, accessible open space will provide rec-
reational and educational opportunities. Forests and pastures also maintain rural character which defines Los Llanos.

“Dark Sky” initiatives can help reduce light pollution at night, thereby maintaining the existing rural character of Los Llanos as well. There are several techniques that can be used to reduce light pollution. Public street lights can be turned off at certain times of the night. Special lights can be installed that emit less light upward into the sky.

Biological corridors can be retained and improved if open space and natural areas are preserved. Allowing for multiple connections through Los Llanos between the two main rivers will help maintain biodiversity. This biodiversity drives the eco-tourism economy of the entire Monteverde Zone. Street trees can also be planted throughout Los Llanos that can serve aesthetic purposes as well as function as urban green space. In certain areas near important biological corridors, public access can be guaranteed by developing only one side of the road on the opposite side of the open area. This can also help maintain views for the public in certain areas, including the views along the main road towards Santa Elena. Views of mountains, valleys, and forests should remain a public resource. (show photos of views lost and retained)
Reforestation projects in these biological corridors can be conducted by a local organization (e.g.; school, Monteverde Conservation League, or a new land trust) as educational projects, tourism attractions, and to provide recreational opportunities. The land behind the proposed church where a new school may be located would be a good place to start a reforestation project.

**Mobility**

Any new development has the potential of generating new traffic. However, vibrant urban centers that are compact allow people to walk short distances to meet their daily needs. This will reduce congestion, as well as the amount of money needed to be spent on roads for automobiles. This will also reduce the amount of automobile traffic generated in Los Llanos. Pedestrian amenities should be the priority for transportation system improvements in the community, as well as alternative modes of transportation like bicycles and public transportation. This means that sidewalks need to be built and benches should be installed. Traffic calming measures should be used to increase safety for motorists and pedestrians. These can include crosswalks, speed bumps, traffic signs and lights, and even street trees. Long, straight, wide roads will speed up traffic, while narrower, curving roads can slow traffic down to a safer speed. Roads with multiple connections will give people more route options, resulting in reduced congestion.

Public pedestrian-only pathways can connect the different sides of Los Llanos to one another, while preserving forested land and other open space from road development. These pedestrian pathways will allow local residents and tourist’s opportunities to experience their natural surroundings, including the forests and rivers in Los Llanos. These pathways will provide connections to nature, and educational and recreational opportunities.

It is also important to reduce traffic through neighborhood streets to prevent accidents with children on those streets and to improve the quality of those neighborhoods. It will be important to use signage to signify which roads are meant for through traffic, and which are meant for local traffic.

Additionally, in areas within and adjacent to important biological corridors, various strategies can be implemented to maintain the integrity of the corridor without obstructing the flow of traffic. Alternative designs can be seen in figure XX.

**Waste and Water Management**

*Solid Waste Management* – The new recycling transfer station can be built closer to a neighborhood to reduce sprawl, and also to strengthen the connection that the recycling center has with local residents. This stronger connection as well as education, especially within schools, can increase the amount of recycling done by residents in Los Llanos. This would reduce the amount of waste produced by current and future residents and businesses while also providing a potential source of income for community residents.

*Water Supply* – Expanding AYA infrastructure may not be the best solution to solving the problem with supply and access to potable water. Conserving water by reducing consumption, especially by tourist related businesses that use a disproportionate share of potable water, should be a priority. A revised local water tariff scheme could help to do this. By charging tourist businesses (especially hotels) more per cubic meter of water consumed per month than residential users, business would be encouraged to reduce gross water consumption levels
while providing more water to the distribution network in the form of water they avoided using. Public educational programs can help achieve this as well, since residents and businesses alike are often unaware of how their individual water use contributes to over-burdening their local supply system. Public lectures, informative brochures, and water awareness posters are all possibilities for increasing public consciousness of water use.

Another solution is to use rainwater harvesting techniques on buildings in Los Llanos (and in the rest of the MV region for that matter). Rainwater harvesting allows individual buildings to collect and use rainwater for their daily household potable water needs. In should be noted that the collected water would most appropriately be used for non-consumption purposes unless treated by a disinfectant process first. Example uses for raw, untreated rainwater include toilet flushing, washing cloths, washing vehicles, and watering plants among others. Pilot rainwater harvesting projects or rainwater harvesting can be done on municipal buildings, including the existing and possible new schools in Los Llanos. This solution is cheap, and easy, and effective. For more information on these systems and others, see Kevin Stewart’s 2007 water report. [cross reference this with my report, maybe not in this way, but somehow]

Water Treatment – It is possible to appropriately treat grey water and black water separately. This can be done at the individual level (and/or communally within neighborhoods)
rather than by building expensive treatment centers or allowing waste the water to go untreated. If neighborhoods are designed to include centralized open green spaces, these green spaces can be used in the treatment of waste water for entire blocks of buildings. Depending upon the exact size, these systems could be constructed to properly treat grey water, black water, or a combination of the two. In this scenario, it’s envisioned that reedbed systems will become widely popular and a common part of open space landscapes. Such systems can directly treat grey water, or black water after it’s been run through a septic tank. For further treatment, and increased aesthetic value, water existing reedbed systems can be directed to small holding ponds where aquatic plants and life (small gold fish) will further refine the water quality before it enters back into ground.

An additional solution to treating black water is simply not use water at all. Dry toilets, or composting toilets, do not use water to safely and efficiently process human (or animal) waste on site. Not only can dry toilet systems be easily installed in existing buildings, they are also amazingly cheap, as they only require little more space than conventional toilets and occasional need to be serviced. The product of these systems is rich hummus, which is perfect for garden or agricultural use. By employing these systems, approximately 30% of daily water use, or 53 liters of water per person per day, could be spared in addition to the costs saved by not building municipal water treatment infrastructure.

Public Services

The need for a new school in Los Llanos will also exist in this scenario. However, the new school could be located behind the proposed church in Barrio Orquideas. This location is more centralized and closer to the current and future population centers in Los Llanos as proposed by this scenario. The location would also be away from a main road, reducing concerns of safety for the children. There is space at this location for recreation, including a large soccer field, trails, and environmental education programs.

A new tourism visitor center may also be located in Los Llanos as a gateway to the Monteverde region. This visitor center can better guide tourists through the available attractions in the area, and provide a pick up and drop off point for tourism buses, reducing tourism related congestion in Santa Elena.

Public trails, parks, plazas, and large tracts of forested land can fill the current void of public space in Los Llanos. These can provide opportunities for youth programming and recreation for local residents as well as tourists, improving both the quality of life for local residents and the tourism experience for visitors.

Economy

Efforts to protect important environmental resources will have a direct and positive influence on the eco-tourism industry in Los Llanos and Monteverde. Retaining open space and biodiversity will keep the community an attractive place for tourists to visit for long periods of time. New pedestrian paths and reforested areas will provide additional attractions for tourists in Los Llanos. The tourism industry will be able to survive because the reasons for its existence in Monteverde will be retained. This may keep unemployment and poverty levels low in Los Llanos, even as population grows. A possible new visitor center, whether in Los Llanos or at some alternative location, will greatly benefit the tourism industry.

The local economy may still be negatively impacted by the reliance on the eco-tourism
industry. Outside ownership may continue to grow, reducing the amount of money kept in the local community generated by tourism (data from 2000 indicate that almost 80 percent of businesses in the Monteverde Zone were owned by residents of the Zone – CITE SOURCE). Increasing land prices as a result of tourism may drive out local families who will no longer be able to afford to live in Los Llanos.

Appendix X provides a detailed list of potential tools and techniques that could be employed to realize the vision set forth in this scenario.
Scenario 3: Economic Diversification

Physical Development

Physical development patterns in an economic diversification scenario may be similar to those of the conservation scenario. Compact development, mixed use urban centers, and preserved open space will be guiding principles for the future development of Los Llanos with a diversified economy. However, a diversified economy is likely to yield a greater number of businesses. These will include storefronts within homes, more working farmland, and more commercial structures.

Figures X through X illustrate examples of how economic diversification development may progress from 2007 to 2030.

Natural Resources

Compact development will allow for the preservation of natural resources and open spaces in Los Llanos. Biological corridors will also be preserved and expanded. These biological corridors can be used to help expand educational opportunities and economic opportunities. A local organization that may be involved in reforestation projects may also be able to generate and sell carbon credits.

Mobility

The goals of pedestrianization will also guide traffic patterns in this scenario. There may be an increased number of pedestrian trails that connect different tourism activities. A pedestrian walkway could connect the proposed church with the mixed use urban center in Barrio Orquedias. This will allow the traffic generated by the church to be steered towards commercial establishments within the center of the community. There may also be new mountain bike trails that provide an expanded set of recreation and tourism opportunities.

Waste and Water Management

Solid Waste Management – The recycling center that may exist in Los Llanos could include organic composting space to further reduce the waste generated by Los Llanos.

Water Supply – The same water tariff schemes and rainwater harvesting systems discussed in the conservation scenario can be used in the economic diversification scenario. These systems will help reduce demand placed on the water distribution network, and increase access and the supply of useable potable water. This will, making make it easier for new businesses to locate in Los Llanos because there will be no water shortages.

Water Treatment – Black water and grey water can continue to be treated separately within this scenario. Black water can be treated communally in the public green spaces within neighborhoods. Grey water can be treated in larger treatment marshes using natural and engineered filtration systems (show photo examples). Grey water would need to be piped or channeled to these treatment marshes from near by buildings. The cleaned treated water can then be reused for other purposes, including large scale agriculture or hydroponics. Additionally, excess hummus produced by buildings employing dry toilets could be used for commercial agricultural purposes.

Yet another economic opportunity exists when employing sustainable systems. Dry toilet users will need an ample supply of carbon based material to have properly functioning
systems. Saw dust or shredded bits of used paper are ideal for this purpose. The recycling transfer station will help fill this market gap, as local entrepreneurs will process discarded paper into a usable form that can then be sold to dry toilet owners.

**Public Services**

A new international and local education center may be created adjacent to the proposed new school location in Los Llanos. A new micro-enterprise development organization may be created to help promote local business creation.

Parks and other public spaces can be created within neighborhoods and preserved outside of developed areas. New neighborhood gardens can be used for youth programming and recreation.

**Economy**

An economy with a diverse base of businesses is one that is more resilient to changes, recessions, and even a decline in tourism. A strong local economy, which is guided by local ownership, local spending, and reusing materials within the community, should be promoted to create a diverse economy. Community members and local institutions, governmental and non-governmental, should actively pursue ways to create local ownership and diversify the economy. Local ownership of the Los Llanos community will allow residents of Los Llanos to shape their own future.

A new cooperative may be developed which provides micro-loans, small business training, and business incubator space to residents wishing to start their own business of any type. A micro-enterprise development program like this can be one of the first steps towards diversifying the local economy. This facility can be located within an existing neighborhood such as La Colina. The high number of female headed households in Los Llanos can be engaged by this organization to promote business ownership amongst these families.

The new recycling center in Los Llanos can be used to generate small businesses. The recycled materials can be used by local artisans, or sold as raw materials by local businesses. Organic composting can also take place at this recycling center. This compost can be sold to local farms and gardens. The alternative water systems that may be developed in Los Llanos, including rain water harvesting and grey and black water treatment, can give local residents the expertise to start businesses designing and constructing these systems in other areas. A new supermarket or food distribution center, which may be developed near the La Colina neighborhood, may generate additional spin off economic activity in its vicinity.

International education opportunities can be created at an institute near the proposed church and new school. Programs can be offered in education, organic farming, reforestation, alternative water supply and treatment systems, and many other subjects. These programs can also be offered free to the local population. These types of institutions bring in long-term tourists and provide opportunities for home stays, an income supplementing activity. There are likely to be additional educational opportunities for the local population offered at the high school in Santa Elena. These can include job training and adult education and will be focused around a new library, a new physical therapy center, and the existing health clinic.

A local organization, such as an existing or newly created land trust, can begin to reforest land to create a web of biological corridors. These reforestation efforts can be used to gen-
erate carbon credits, which will create a source of income for that organization, and provide the means to complete additional reforestation projects. If forests and habitats are preserved, Los Llanos may have the opportunity to have small businesses develop that cultivate and harvest medicinal plants.

An organic agricultural industry can be developed by reusing treated grey water from the grey water treatment marsh to irrigate. By reusing water, this agriculture will not put increased demand on the water supply. Organic farms, greenhouses, and shade grown coffee plantations can be developed in Los Llanos (show organic farm and greenhouse photos). The market for organic agriculture is growing world wide. Farm-stay programs can be developed on these farms to provide a source of labor and to generate more spending on other businesses in the area. Community supported agriculture programs, in which residents buy into farms and receive produce, can also be used to help promote local agriculture.

Neighborhood gardens can be developed to provide produce for local residents and provide employment and recreational opportunities for youth and the elderly in Los Llanos. Products from these farms and gardens can be sold at a new farmers market located in one of the future urban centers in Los Llanos. A farmers market will make local agriculture a more viable economic activity. This farmers market can also be a location for local artisans to sell their products.

There are many additional tourism opportunities that can be capitalized on in Los Llanos to further diversify the tourism economy. The new visitor center can steer people to locally owned attractions. Pathways originating at the visitor center can connect to different tourism attractions, including the organic farms, greenhouses, and coffee farms. Mountain bike trails and horse trails can also be used to create locally-owned business based on these attractions.
Comparisons
There are several characteristics of the three possible scenarios that make each distinct.

Natural Resources
Within each scenario, the types and quantities of land cover are different quite dramatically. The existing land cover from 2005 is compared with the potential future land cover of Los Llanos in 2030 for each of the three scenarios in Figures X through X.

The land cover data in Table X demonstrates that the Business-As-Usual scenario will consume much of the existing open space for developed land. The Conservation scenario preserves the most open space of the three scenarios. The Economic Diversification scenario preserves nearly the same amount of open space while realizing a higher diversity of land cover based on the different land uses possible for this scenario.

(Figures X through X) depict biological corridors and reforestation. In the Business-As-Usual scenario there are no biological corridor connections between the Rio Lagarto and Rio Guacimal in Los Llanos. In the Conservation scenario and the Economic Diversification scenario there is the possibility of multiple corridor connections through Los Llanos.

Measures can be taken to provide an enclosed canopy over roadways to provide for the unhindered movement of regionally important animal species. Figure XX depicts several of strategies that could be implemented in Los Llanos to allow bio corridors to cross roadways.
**Structures**

Table X depicts the total number of structures within each of the three possible scenarios. The same number of housing units exists in each scenario. In the Business-As-Usual scenario, each housing unit uses a separate structure and each business uses a separate and sometimes multiple structures. There may be more commercial structures in the Business-As-Usual scenario, but there are more businesses in the Conservation and Economic Diversification scenarios. The following maps show the types of structures in Los Llanos in 2007 and the possible locations of different types of structures in the three scenarios in 2030.

Because of the increased density mixed-use, fewer structures are needed in the Conservation and Economic Diversification scenarios than the Business-As-Usual scenario. As a result, this denser development takes up less space.

<table>
<thead>
<tr>
<th>Type</th>
<th>Los Llanos 2007</th>
<th>Business as Usual 2030</th>
<th>Conservation 2030</th>
<th>Economic Diversification 2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential - Single Family</td>
<td>320</td>
<td>1,030</td>
<td>790</td>
<td>770</td>
</tr>
<tr>
<td>Residential - Apartment</td>
<td>4</td>
<td>4</td>
<td>29</td>
<td>29</td>
</tr>
<tr>
<td>Residential - Apartment with Commercial</td>
<td>0</td>
<td>0</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Residential - Single Family with Commercial</td>
<td>7</td>
<td>10</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Commercial - Tourism</td>
<td>44</td>
<td>61</td>
<td>55</td>
<td>57</td>
</tr>
<tr>
<td>Commercial - Local</td>
<td>18</td>
<td>36</td>
<td>25</td>
<td>48</td>
</tr>
<tr>
<td>Institutional - School</td>
<td>31</td>
<td>7</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Institutional - Other</td>
<td>0</td>
<td>6</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Under Construction</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total Structures</strong></td>
<td><strong>436</strong></td>
<td><strong>1,161</strong></td>
<td><strong>945</strong></td>
<td><strong>973</strong></td>
</tr>
</tbody>
</table>

Figures X through X demonstrate three alternative community designs that may exist in Los Llanos in the future. The first design, which is characteristic of current development patterns (i.e., business-as-usual) illustrates scattered strip development without a clear center. The second design shows a higher density residential neighborhood surrounding public green space. This green space can serve a variety of functions as noted above. This type of development may exist in the Conservation and Economic Diversification scenarios. The third design is of two vibrant, dense, mixed-use urban centers that also exemplify possible conservation and economic diversification scenarios.

**Population Distribution**

Figures X through X demonstrate population density in different neighborhoods of Los Llanos in 2007, and possible population densities for each of the three alternative scenarios in
In the Business-As-Usual scenario, population is dispersed along all of the existing and potential roadways. In the Conservation and Economic Diversification scenarios, population is concentrated in a small number of vibrant urban centers.

**Roads**

Table X demonstrates that the low density, scattered development in the Business-As-Usual scenario will require more roads to be built than in the other two scenarios. Although land developers must build the roads to subdivide land, the municipality is responsible for their maintenance. The cost of maintaining the Business-As-Usual development style will be higher for the municipality than the other two scenario development styles.

<table>
<thead>
<tr>
<th>Type</th>
<th>Los Llanos 2007 (meters of road)</th>
<th>Business as Usual 2030 (meters of road)</th>
<th>Conservation 2030 (meters of road)</th>
<th>Economic Diversification 2030 (meters of road)</th>
</tr>
</thead>
<tbody>
<tr>
<td>National</td>
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<td>2,400</td>
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<tr>
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<tr>
<td>Private</td>
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<td>1,557</td>
<td>1,654</td>
</tr>
<tr>
<td>Total</td>
<td>11,710</td>
<td>19,398</td>
<td>15,409</td>
<td>15,506</td>
</tr>
</tbody>
</table>

Figures X through X demonstrate traffic patterns in Barrio Orquedeas and how they
vary by scenario. In the Business-As-Usual scenario, traffic will spill into the neighborhoods, clogging residential streets with cars. In the Conservation and Economic Diversification scenario, traffic is diverted around the neighborhood on a newly designed road.
APPENDIX X
CONSERVATION TOOLS AND TECHNIQUES

One of the first tools that should be implemented to realize the vision set forth in the Conservation and Economic Diversification scenarios is enforcement of existing environmental regulations (a list of existing environmental regulations relevant to the Monteverde region can be found in the Natural Resources section of this planning document). Without enforcement it is more than likely those regulations will be ignored by the development community and that their individual decisions will lead to large cumulative impacts resulting in widespread environmental degradation.

The most effective tool for enforcement is the development of an efficient regulatory planning and review process that provides the opportunity to determine whether proposed developments meet the existing environmental legal requirements. This could be accomplished through the creation of a Board of Environmental Review implemented within the existing permit review process of the Municipal Government of Monteverde. This board should be given authority to request changes in the proposed development plan and to deny permits based on violation of existing regulations and environmental impacts. Should the Municipality adopt additional conservation design guidelines, such as those listed below, the Board of Environmental Review should be vested with the authority to evaluate project proposals under the new guidelines, as well.

As noted in the Natural Resources section, one of the most difficult challenges facing communities today is protecting natural areas in the face of rapid population growth and land-consumptive development patterns. One method communities can implement is conservation design and zoning, which is principally intended to protect biodiversity, conserve community resources, preserve natural areas, and protect the health and safety of the community. Below are several concepts and regulations the Municipality could implement to realize the vision set forth in the Conservation and Economic Diversification scenarios:

Sample Concepts and Regulations
Develop Conservation Zones within the region – these zones would be drawn on maps and include existing forested areas, riparian areas adjacent to major rivers, and other special topographic and environmental features that merit conservation, as well as areas of proposed connectivity. It is imperative that these areas be mapped to ensure their protection during the environmental review process described above.

Open space and natural area set-asides – a certain percentage of each development site should be set aside as permanent open space or natural area. These areas should not include landscaped features such as islands located in parking lots or other similar features. Set-asides should not include areas unbuildable due to existing environmental regulations or physical characteristics of the site (e.g., soils, slopes).

Clustering of lots and buildings – buildings and parking lots should be grouped to minimize negative impacts on the natural, scenic, and cultural resources of the site and conflicts between incompatible uses. Groups should avoid encroaching on forest communities and other high quality habitats. Whenever possible, open space and natural areas should connect with existing or potential open space lands on adjoining parcels and local or regional recreational...
trails. The exact layout should also encourage a sense of community through the use of communal space (e.g., public gardens or parks).

Viewshed protection – height restrictions and open space requirements should be designed to protect important scenic views. By identifying and mapping important viewsheds and scenic views from key scenic roads, public parks, and other locations valued by a community, standards can be developed to minimize the impact of man-made structures and grading on views of existing landscapes and open spaces as seen from designated public roads.

Roadway and sidewalk design – roads should be designed to minimize impervious surfaces and should include enough additional space for sidewalk/pathway placement on at least one side of the roadway. Walkways should be provided from residential areas to common open space and other natural areas to provide convenient pedestrian access throughout the conservation development and from the conservation development to other areas of the community. If the proposed walkway system provides pedestrian access equal to or better than the provision of sidewalks along street rights-of-way, sidewalks requirements along public streets could be waved.

Dark skies – the primary purposes of dark skies regulations and ordinances are to minimize the impact of light pollution to human health, nocturnal wildlife and ecosystems, improve nighttime ambience, and to conserve energy. These ordinances should permit reasonable uses of outdoor lighting for nighttime safety, utility, security, and enjoyment while preserving the ambiance of the night. To accomplish this, all lighting installations shall be designed and installed to be fully shielded and shall have a maximum lamp wattage of 250 watts for commercial lighting, 100 watts incandescent, and 26 watts compact fluorescent for residential lighting. In residential areas, light should be shielded such that the lamp itself or the lamp image is not directly visible outside the property perimeter.