

## **The City of Batna: Determinants on Urban Expansion (Easements - Constraints) and Alternative Options Available**

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### **Abstract**

Greater Batna is significant on multiple levels (local, regional, national). Its beginnings were for military purposes, hence the choice of its location was not given sufficient importance. The location is challenging, complex, and surrounded by many obstacles that later became barriers to its urban expansion, especially after it became saturated and could no longer accommodate the high demand for land to meet its expansion needs resulting from significant population increases.

Thus, city officials must think of serious solutions to meet Batna's expansion needs according to a comprehensive vision with at least two planning levels (Provincial Land Development Plan PAW, and the Master Plan for Development and Urban Planning PDAU) and within specific time frames.

In this research paper, we attempted to provide solutions and suggestions that we see as scientific and practical to solve Batna's urban expansion problem. Priority was given to internal expansion by utilizing available vacant pockets, and later outside its urban perimeter according to two formats: first, linear expansions along the main road axes (National Roads 03 and 31), and second, by creating balancing poles with Batna as the mother and dominant city surrounded by four balancing poles within its provincial territory, achieving what is known as urban integration.

### **Keywords:**

Urban Expansion, Obstacles and Constraints, Expansion Options, Balancing Poles, Road Axes.

## Introduction

Due to various factors, primarily significant demographic growth, construction activities have accelerated, with urban expansion being one of its manifestations. This phenomenon has affected most Algerian cities, initially resulting in extensive consumption of land. As the demand for land increased, many cities and municipalities across the nation experienced legal encroachments on agricultural land. The absence of local authorities' regulatory power led to chaotic urban development despite the existence of urban planning and development tools that lacked strict enforcement.

The city of Batna, the seat of both the municipality and the province, is one such city. It is considered the most important in its provincial region and, on a larger scale, holds the fourth position in significance among the cities of eastern Algeria, following Constantine, Annaba, and Setif. Due to its administrative status and economic dynamism, Batna attracted additional residents, reaching a population of 350,251 in 2022. This population increase heightened the demand for land to meet the needs of the growing number of residents, exacerbating the city's existing problems caused by its challenging location and site-specific characteristics. This situation limited its expansion options, leading to the critical question: "Where will its future urban expansion occur?" This paper aims to answer this question.

### 1. Location of the Study Area (City of Batna)

#### 1.1. Astronomical Location

Batna is located between the following coordinates:

- Longitude: Between  $7^{\circ} 10'$  and  $7^{\circ} 17'$  East of Greenwich.
- Latitude: Between  $35^{\circ} 40'$  and  $35^{\circ} 46'$  North of the Equator.

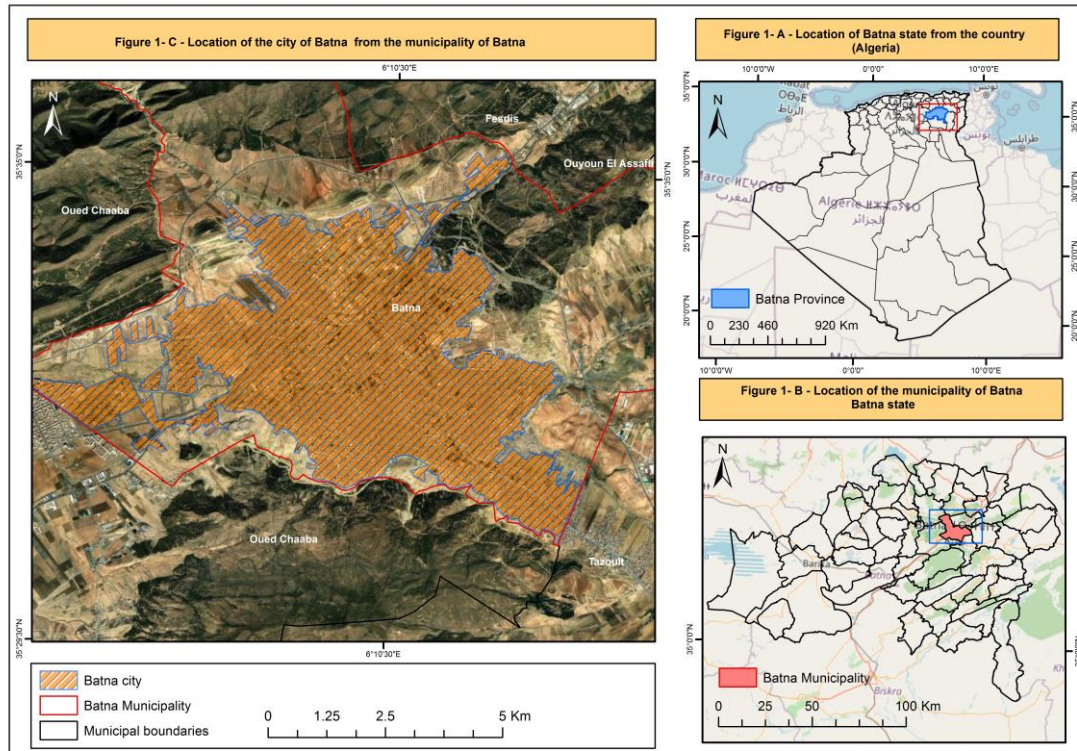
#### 1.2. Geographical Location

Geographically, Batna belongs to the region of the high plains of Constantine and is surrounded by the Aurès mountain range. It is situated at the intersection of national roads No. 03, 31, and 77, connecting it to Constantine to the north, Biskra to the south, Khenchela to the east, and Setif to the west (PDAU BATNA, 2008, p. 86).

#### 1.3. Administrative Location

The municipality of Batna is one of the 61 municipalities that form Batna Province. Administratively, it is bordered by the following municipalities: to the north by Seriana

and Fesdis in the north and northeast, to the east by Aïn Yagout, to the southeast by Tazoult, to the south and west by Oued Chaaba, and to the northwest by Oued El Ma.



**Figure 1:** Administrative Location of the City and Municipality of Batna

**Source:** Prepared by the researcher – March 2024

## Materials and Methods

### 1. Urban Expansion Barriers (Natural and Artificial Obstacles)

#### 1.1. Natural Obstacles

These generally consist of mountains and valleys.

##### 1.1.1. Mountains and Forests

The city of Batna is situated on a plain at an average elevation of 1040 meters above sea level, surrounded by mountainous terrain (the Belzma and Aurès Mountains) covered with sparse vegetation, forming a barrier to its future expansions. This is true from almost all directions except for the road axes leading out of the urban perimeter towards the municipalities of Tazoult to the southeast, Oued Chaaba to the southwest, and Fesdis to the northeast, which over time have become axes of linear urban development. (Anser Saad, 2009, p. 96).

### 1.1.2. Valleys

The region of the Batna municipality and its urban fabric is crossed by a moderately dense water network with temporary flows descending from the eastern heights of the municipality, primarily consisting of two main valleys:

- **Oued Batna:** It crosses the city from east to west.
- **Oued El Ghorzi:** It crosses the city from south to north.

Wadi Azab and Wadi Bouaiden are significant branches of these main valleys, crossing the city through two channels designed to prevent flood risks. However, it should be noted that these channels are unable to accommodate large volumes of water. (Bouras Chahrazad, 2001, p. 102) (Figure 1).

The nature of Batna's location, surrounded by mountains, makes it periodically susceptible to flooding from these valleys, causing considerable damage. These valleys also pose an obstacle to the city's future urban expansions.

## 1.2. Artificial Obstacles

### 1.2.1. Industrial Zone

The industrial zone in Batna was established in 1971 and is located northwest of the city. It is bordered to the south by the major urban area (City of Batna), to the west by the Kchida neighborhood, to the east by two high-voltage power lines (30 kV and 60 kV), and to the northwest by the activity zone and urban sector (Sector 04). The industrial zone covers an area of 535.24 hectares (Master Plan for Development and Urban Planning, 1998, Phase 02, p. 48).

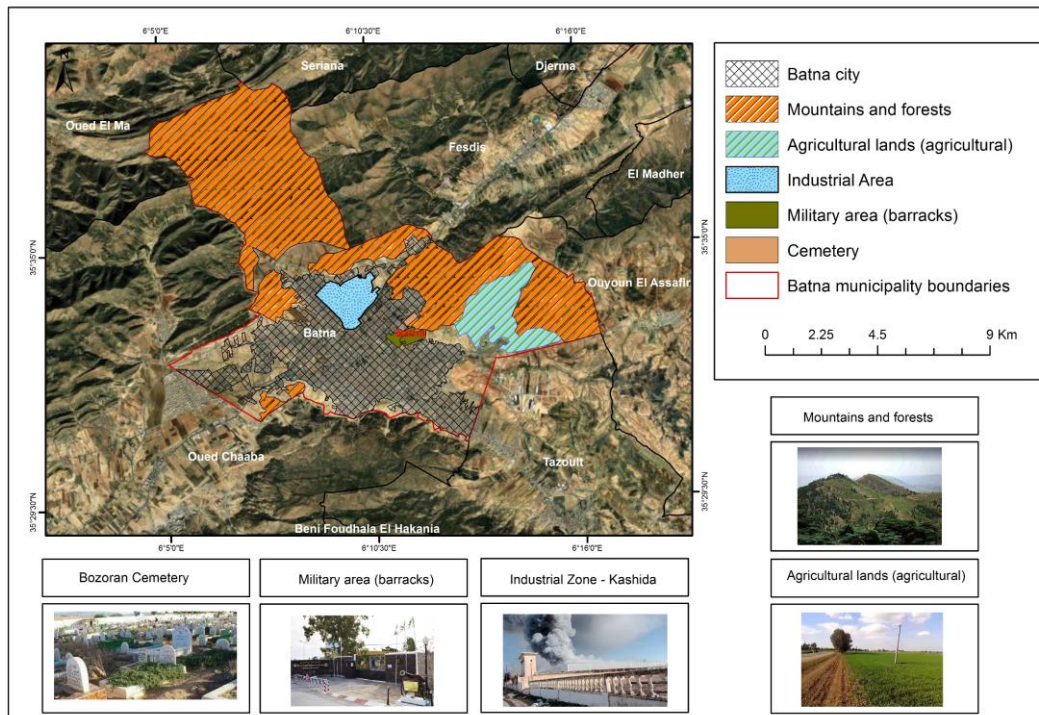
Today, the industrial zone represents a significant barrier to the city's urban expansion to the northwest (Map No. 01).

### 1.2.2. Military Zone

The military zone (barracks) covers an area of 107.33 hectares (Bouras Chahrazad, 2001, p. 28). It is located in the northeast of the city, situated on both sides of Boukhoulf Mohamed El Hadi Street. It is bordered to the north by the ECOTEC buildings, to the south by Salah Eddine Al Ayyoubi High School, to the east by the Park Aforaj neighborhood, and to the west by the city center and the central university. The location of the barracks is not suitable as it occupies a significant land area in a highly strategic location, which could be utilized for other purposes (housing, facilities, etc.). Additionally, military use is not safe when located in the city center.

### 1.2.3. Railway

The railway crosses the urban fabric of Batna, posing a danger due to non-compliance with legal setbacks (protection corridors) during construction (e.g., the 800 Housing Project). This causes traffic disruptions and accidents. Urbanistically, it creates fragmentation in the urban fabric and significant connectivity issues between different neighborhoods of the city.



**Figure 2: City of Batna: Expansion Barriers (Natural - Artificial)**

**Source:** Prepared by the researcher – March 2024

#### A.1. Steep Slopes

Steep slopes also pose a barrier to the city's expansion. The city is surrounded by areas with very steep slopes, particularly to the northeast and west, where the gradient exceeds 15%. From an urban planning perspective, these areas are unsuitable for development due to technical considerations and the additional financial costs required to execute projects in such terrains.

#### A.2. Agricultural Land

The city is surrounded by agricultural land to the northeast and west, limiting its expansion in these directions. Furthermore, the Master Plan for Development and Urban Planning for Batna Municipality recommends protecting these high-yield agricultural lands.

### A.3. Groundwater Zones

This zone extends over a significant area of the Batna municipality, specifically to the east, where there are more than eight artesian wells supplying the city with potable water. The risks of developing over this important groundwater table are well known, necessitating caution when planning any future urban expansion in this area.

### B.1. Artificial Risks and Barriers

These types of risks and barriers are multifaceted and significantly hinder the expansion of the city of Batna in several directions. The main ones include:

#### B.2. High Voltage Power Lines

High voltage power lines (22,000 volts) originate from the electricity generation station in Draa El Hadja, M'Sila Province. When passing through the Batna municipality, they are classified as an artificial barrier to urban expansion. Overcoming this requires the creation of a safety corridor (setback) on both sides, prohibiting any construction above or adjacent to it. The law mandates respect for this setback under any circumstances.

#### B.3. Administrative Boundaries of the Municipality

From an administrative perspective, boundaries indeed present a challenging barrier, especially considering the municipality has exhausted most of its land reserves for development, amidst numerous natural and artificial obstacles. Specifically, the borders with the municipalities of Oued Chaaba to the southwest and Oulad Tazoult to the southeast pose significant challenges, necessitating local officials and urban planners to seek alternative solutions to meet Batna's expansion needs.

#### B.4. Cemeteries

Cemeteries occupy an area of 20.94 hectares, representing another barrier to the city's expansion. The largest cemetery area is located to the northeast of the city in Urban Sector 6, occupying a large area of 15.7 hectares.

### 2.3. Population Estimates (Current - Future)

The population of Batna was estimated at approximately 350,251 in the 2022 census. With an annual growth rate between 1.52% and 1.38%, this number is expected to reach about 395,177 by 2030 and 528,382 by 2040.

**Table 1:** Population Estimates for Batna (Short-term - Medium-term - Long-term)

Time Horizon	Census Year 2022	Short-term 2030	Medium-term 2040	Long-term 2052
Population (people)	350251	395177	450643	528382

<b>Annual Growth Rate</b>	1.52	1.41	1.38
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**Source:** General Census of Housing and Population 1998 - Researcher's Estimates March 2024.

### 1. Estimation of Housing Needs (Current - Future)

We can estimate future housing needs by knowing:

- Housing Occupancy Rate (TOL): 5.64 individuals/house.
- Number of houses in Batna in 2022: 53,217 houses.
- Number of houses needed theoretically = Estimated population ÷ TOL.

From Table 2, we find that the population increase is estimated at 44,926 people by 2030 and 77,739 people by 2052, which is a relatively large and concerning increase.

**Table 2:** City of Batna: Current and Future Housing Needs (2022 – 2052)

<b>Time Horizon</b>	<b>Census Year 2022</b>	<b>Short-term 2030</b>	<b>Medium-term 2040</b>	<b>Long-term 2052</b>
<b>Population Increase (people)</b>		44926	55466	77739
<b>Housing Deficit (units)</b>	5158			
<b>Housing Needs (units)</b>		7966	9834	13783

**Source:** General Census of Housing and Population 1998 - Researcher's Estimates March 2024

### 2. Estimating Facility Needs

It is possible to estimate the city's needs for public facilities and equipment based on the theoretical equipment grid (La grille théorique d'équipement), considering that Batna belongs to the category of cities with a population size of 350,000 - 500,000 people in the short and medium-term horizons.

Local officials are particularly concerned about the resulting demand for housing, both in terms of deficits and future needs across various time horizons (2030 – 2052). Translating these numbers into reality requires providing the necessary land to build all these housing units and certainly other facilities (public utilities, roads, technical networks, green spaces, playgrounds, etc.). This raises a crucial question: Where will all these people be housed? Are the required land parcels available?

Therefore, it is essential to seriously explore options for the city's expansion that are logical and capable of accommodating these cumulative population increases and housing demands.

## **2. Urban Expansion Options for the City of Batna (Present - Future)**

### **1.2. Option of Internal Expansion (within the urban perimeter)**

#### **1.1.2. Utilizing Vacant Pockets**

The city of Batna can achieve expansion within its current urban perimeter in the very short term by utilizing available vacant pockets.

#### **1.1.2. Definition of a Vacant Pocket**

A vacant pocket is a land area within the existing urban fabric, free from any protection corridor constraints, not designated for any current or future urban function, and suitable for development. It allows for the realization of an urban project through urban densification. (Nasr Soumia, 2005, p. 25).

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## **Results and Discussion**

## **2. Urban Expansion Options for the City of Batna (Present - Future)**

### **2.1. Option of Internal Expansion (within the urban perimeter)**

#### **2.1.1. Utilizing Vacant Pockets**

The city of Batna can achieve expansion within its current urban perimeter in the very short term by utilizing available vacant pockets.



### **2.1.2. Definition of a Vacant Pocket**

A vacant pocket is a land area within the existing urban fabric, free from any protection corridor constraints, not designated for any current or future urban function, and suitable for development. It allows for the realization of an urban project through urban densification. (Nasr Soumia, 2005, p. 25).

#### **1.1.2.1. Existing Vacant Pockets**

Across various urban sectors of Batna, a significant number of vacant pockets have been identified, with 5 of them being municipally owned and the rest privately owned. Most of these vacant pockets have an estimated total area of 58,341 square meters.

#### **1.1.2.2. Potential Utilization of Vacant Pockets**

The previously mentioned vacant pockets can be utilized to create public facilities to address the deficit in equipment in the urban sectors where these vacant pockets are located. The military area, which spans approximately 112.78 hectares, can be relocated to the suburbs, and its area can be used to meet the city's needs for public facilities currently recorded as deficient.

### **2.2. Options for External Expansion (outside the urban perimeter)**

In the medium and long-term horizons, Batna must explore other options beyond its current urban perimeter. The main solutions or suggestions can be summarized as follows:

#### **2.2.1. Expansion along Road Axes: An Inevitable Reality**

Faced with numerous obstacles (natural, artificial) and having exhausted most of its reserves, the municipality and city of Batna have limited expansion options. Expanding along the main road axes (linear expansion) has become an inevitable choice due to the rapid development along these axes and the municipality's inability to curb this trend. This has led to the regularization of illegal situations with the enactment of Law 08-15, which defines the rules for the conformity of buildings and the completion of their construction. The main axes, in order of priority, are as follows:

##### **2.2.1.1. National Road 31 Axis (Batna – Tazoult) (Illegal Development)**

With a length of approximately 5.76 km (PDAU 1998, p. 63), illegal development has been recorded (residents have ownership documents and built their homes without building permits), resulting in chaotic urbanization encouraged by the lack of supervision from the relevant authorities and the Urban Police. Consequently, Batna has urbanized along the axis connecting it to Tazoult, unfortunately at the expense of agricultural land.

##### **2.2.1.2. National Road 03 Axis (Batna – Constantine) (Legal Development)**

The area along this axis has been classified as a suitable option for development (topographical suitability) and extends north towards Fesdis. With ongoing

development, urban cohesion between Batna and Fesdis is expected in the short term, especially after the establishment of significant commercial, healthcare, and educational facilities such as Batna University 02. Fesdis will effectively become a subsidiary city of Batna. (See Map No. 02).

#### **2.2.1.3. National Road 03 Axis (Batna - Oued Chaaba) (Planned Development)**

Development along this axis is planned, with Batna's urban expansions scheduled in this direction (southwest), such as Hamma 01 and Hamma 02, which have absorbed over 80% of AADL 1 and 2 housing projects. Hamma 3 is entirely planned within the territorial limits of Oued Chaaba along the same axis.

### **Results**

From the above, we can deduce the following facts:

- Significant population increases.
- High demand for housing and public facilities.
- Scarcity of land and largely exhausted land reserves.
- Numerous natural and artificial obstacles.

Therefore, Batna needs scientifically and practically studied solutions that are also urgent to address the issue of future urban expansion across different time horizons (short, medium, long-term).

### **Role of Urban Planning and Development Tools (PDAU PAW) in Solving the Problem**

To solve the issue related to the urban expansion of the large urban center of Batna, the matter was addressed from a planning perspective. It was decided to prepare a master plan for a group of municipalities (Batna, Fesdis, Oued Chaaba, Tazoult, Ain Yagout, Ghoumra, Seriana) to achieve the following goals:

- Rebalancing and rational distribution of structures.
- Reducing pressure on urban centers, especially Batna. (PDAU Ph 02 P 2).
- Curbing random expansion and attempting to regularize illegal situations according to Law 08-15.
- Activating monitoring and deterrence mechanisms for all urban violations.

#### **2.2.2. Option of Expansion in Small Towns (Balance Poles)**

Batna's urban expansion faces a significant challenge, as mentioned earlier, due to the exhaustion of its land reserves, making it impossible to achieve this in the medium and long term. Therefore, the idea of meeting its expansion needs in the territorial limits of neighboring municipalities was proposed. This aims to stabilize the population in their original municipalities and reduce their influx into Batna, the capital of the province. The proposed municipalities for this approach are:

1. Municipality of Fesdis
2. Municipality of Tazoult

3. Municipality of Oued Chaaba
4. Municipality of Aïoun Elassafer

### **The Selection of These Municipalities and Towns for the Following Considerations**

- They have significant land reserves that can meet Batna's expansion needs.
- A large proportion of immigrants to Batna come from these municipalities and towns.
- These towns are well connected to Batna by a network of roads (national, dual carriageways).
- The proximity between these towns and Batna (between 10 – 15 km).

#### **1. City of Fesdis**

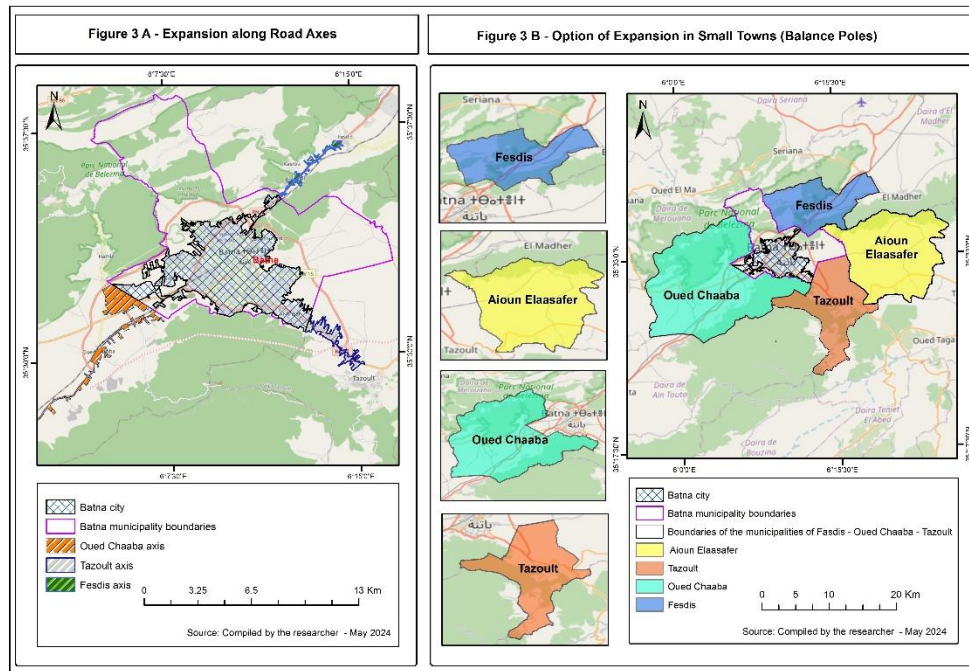
Located northeast of Batna, 10 km away, covering an area of 8,580 hectares. It is bordered to the north by Seriana, to the east by El Madher, to the south by Ain Yagout, and to the west by Batna. It was initially a secondary settlement under the municipality of Batna and was promoted to a municipal seat during the administrative division of 1984. It can achieve urban integration and alleviate pressure on Batna.

#### **2. City of Tazoult**

Located southeast of Batna, bordered to the north by Ain Yagout and Batna, to the east by Oued Taga, to the west by Oued Chaaba and the southwestern part by Beni Fodhala. It covers an area of 112.52 hectares.

#### **3. City of Oued Chaaba (Lambridi)**

Located in a plain area southwest of Batna, 10 km away, bordered to the north by Oued El Ma, to the east by Batna, to the west by Hidoça, and to the south by Beni Fodhala and Ain Touta. It covers an area of 24,567 hectares and was promoted to a municipal seat during the administrative division of 1984.



**Figure 3:** Batna city - Options for future expansion

**Source:** Prepared by the researcher – May 2024

#### 4. City of Aioun Elassafer

Located east of Batna, bordered to the north by El Madher, to the east by Timgad, to the south by Oued Taga and Tazoult, and to the west by Batna. It covers an area of 1,600.5 hectares and was promoted to a municipal seat during the administrative division of 1984.

If this vision is realized, Batna (the mother city) will be the dominant urban center, and these four towns (Fesdis, Tazoult, Oued Chaaba, Ain Yagout) will be the balancing poles.

#### Conclusion

Batna faces significant challenges in urban expansion, necessitating strategies both within its current perimeter and beyond. Internally, the city can utilize vacant pockets totaling about 58,341 square meters and relocate the military area to the suburbs, freeing 112.78 hectares for public infrastructure. Externally, expansion along major road axes and into neighboring municipalities like Fesdis, Tazoult, Oued Chaaba, and Aioun Elassafer is essential. These areas provide substantial land reserves and connectivity to Batna. Developing a master plan for Batna and surrounding municipalities is crucial for balanced growth, reducing urban pressure, and regularizing illegal constructions. This integrated approach aims to ensure sustainable urban development and improve residents' quality of life across the region.

## References

1. Ansar Saad, Gaskil Um Khair, "Urban Expansion Mechanisms and Urban Land Issues in the City of Batna", Earth Sciences Institute, University of Batna, 2009.
2. Bouras Shahrazad, "Spatial Dynamics and Urban Forms in the City of Batna", Master's Thesis, University of Constantine, October 2001.
3. Fatiha Samai, Farida Daas, "Urban Cohesion: The Case of Batna-Tazoult", Urban Planning Graduation Memoir, Earth Sciences Institute, University of Batna, 2004-2005.
4. Khlef Allah Boujemaa, Urbanization and the City, Al-Huda Publishing, Printing, and Distribution House - Ain M'lila, 2005.
5. Ministry of Equipment and Urban Planning "Algeria Tomorrow" Status of the National Territory, Recovery - National Territory, University Publications Office, Algeria 1995.
6. Nasr Soumia, Sbihi Narges, "Urban Proposals for the Valorization and Utilization of Vacant Pockets in the City of Batna", Department of Earth Sciences, University of Batna, 2005.
7. Pierre Merlin, "L'Aménagement du territoire", Presses Universitaires de France - PUF, September 2002.
8. Statistical Guide 2008 for the Directorate of Planning and Urban Development (D.P.A.T) of the Batna Province.
9. Taji Bashir, Urbanization and Urban Planning in Algeria, University Publications Office, Algeria, 2000.

## Laws

1. Law 08-15 dated July 20, 2008, defining the rules for the conformity of buildings and the completion of their construction, Issue No. 44.
2. Law No. 87-19 dated December 8, 1987, regulating the exploitation of agricultural lands belonging to the national estate and defining the rights and duties of producers.
3. Law No. 90-29 dated December 1, 1990, related to land development and urban planning.
4. Law No. 06-06 dated February 20, 2006, containing the guiding law of the city, Official Gazette No. 15.
5. Housing and Population Census (R.G.P.H) of 2022.

## Urban Plans

1. Master Plan for Development and Urban Planning (PDAU) of the Municipality of Batna, Phase 02, 1998.
2. Review of the Master Plan for Development and Urban Planning for the group of municipalities (Batna, Fesdis, Oued Chaaba, Tazoult, Ain Yagout, Ghormassa, Seriana) (URBA-BATNA), (Phase 01 November 2006) (Phase 02 January 2009).
3. DPAT W. De BATNA - The Monograph of the Batna Province – 2006

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