

3.3 Water Resources Management

(1) Current Legislation on Water Resources Management

The 1991 Constitution of the Republic vests the ownership of subsoil, and of natural and nonrenewable resources on the state (Art. 332). Major decrees, laws, resolutions related to water resources management are listed in the table below.

Table- 3.9 Laws and Regulations Related to Water Resources Management

Type	Legislation No.	Level	Description
Water Resources Management			
Decree-Law	2811, Dec. 18, 1974	National	National Code of Renewable Natural Resources and Protection of Environment
Decree	1541, Jul. 26, 1978	National	Non-marine Water Management (Particular Regulation of Part III, Book II of Decree 2811, 1974, Modified by Decree 2858 of 1981)
Decree	1681, Aug. 4, 1978	National	Hydro-biological Resource (Particular Regulation of Part X, Book II, of Decree 2811, 1974)
Decree	1594, Jun. 26, 1984	National	Water Use and Effluent Discharge (Clarified by Decree of 2340, Sep. 19, 1984)
Decree	2857, Oct. 13, 1981	National	Hydrographic Basin (Particular Regulation of Part XIII, Title 2, Chapter III, Decree 2811, 1974)
Decree	2858, Oct. 13, 1981	National	Permission of Hydrological Study (Particular Regulation of Article 56 of Decree 2811, 1974)
Decree	1594, Jun. 26, 1984	National	Water Use and Effluent Discharge (Clarified by Decree of 2340, Sep. 19, 1984)
Law	79, Date-unknown, 1986	National	Conservation of Water
Law	99, Dec. 22, 1993	National	Establishment of Ministry of Environment, Public Sectors in Charge of Management and Conservation of Environment, Organization of National Environmental System
Law	373, Jun. 6, 1997	National	Program for Efficient Use and Saving of Water
Decree	901, Apr. 1, 1997	National	Rate for Use of Water
Decree	1604, Jul. 31, 2002	National	Joint Commissions for Basin Management
Decree	1729, Aug. 6, 2002	National	Basin Management Plans
Accord	CAR, 10, Mar. 6, 1989	Cundinamarca	Non-marine Water Management in Cundinamarca Department
Accord	CAR, 8, Mar. 17, 2000	Cundinamarca	Rates for Use of Water in the Territory of CAR
Groundwater			
Resolution	DAMA, 250, Apr. 16, 1997	Urban Zones in Bogotá D.C.	Rate (Unit Fee) for Use of Groundwater
Resolution	DAMA, 251, Apr. 16, 1997	Urban Zones in Bogotá D.C.	Registration of Wells
Resolution	DAMA, 815, Sep. 6, 1997	Urban Zones in Bogotá D.C.	Meter Installation in Wells for Groundwater Abstraction
Resolution	DAMA, 1219, Sep. 29, 1998	Urban Zones in Bogotá D.C.	Payment of Fee for Use of Groundwater
Water Supply and Sanitation			
Law	9, Jan 24, 1979	National	Sanitary Measures
Decree	475, Mar. 10, 1998	National	Technical Norms of Drinking Water
Decree	2105, Jul. 26, 1983	National	Potable Water (Particular Regulation of Title II of Law 9, 1979)
Decree	748, Nov. 24, 1995	Bogotá River	Fund for Wastewater Treatment- Bogotá River
Wastewater Discharge			
Resolution	DAMA, 1074, Oct. 28, 1997	Bogotá D.C.	Standards of Effluent (the chart is missing)

(a) Decree-Law No. 2811 of 1974-National Code of Renewable Natural Resources and Environmental Protection

Decree-Law 2811 of December 18, 1974, named as “National Code of Renewable Natural Resources and Environment Protection”, is the fundamental law of water resources management. All waters in any condition and any location of the territory is recognized as renewable natural resource (Art. 3). In the Code, renewable natural resources are deemed as common patrimony of the nation, and the state shall participate in their preservation and management as social interests (Art 1). Conservation, improvement and rational use of them shall be made with the maximum social participation to assure harmonic development for the benefits of health an well-being of the present and the future nation (Art. 2)

Book II of the Code stipulates priority, use and the environmental influence of renewable natural resources. Part I of Book II gives general provisions for i) administrative activities related to renewable natural resources, ii) rules of reservation, iii) priorities, vi) modes to acquire rights to use renewable natural resources, v) registry, vi) restriction and limitation to private domain and the use. Part III of Book II gives dispositions specific to non-marine water, including those, i) modes to acquire rights to use, ii) exploitation and occupation of the water beds, water front and water courses, iii) easement, iv) hydraulic works, v) conservation and preservation of water, vi) groundwater (Art. 149-154), vii) administration of water and the beds, viii) charging, ix) water users association, x) sanctions. Part XII of Book II provide modes of management of renewable natural resources, and Chapter III of the part gives dispositions on hydrographic basins.

(b) Decree No. 1541 of 1978

Decree No. 1541 of 1978 gives detail provisions on non-marine water based on the Code of Renewable Natural Resources and Environmental Protection. The Decree defines types of domains, such as public or private, of non-marine water as well as riverbeds. Main part of the decree destined for manners and procedure for giving rights to use of non-marine water and watercourses to individual persons, including juridical ones.

DAMA (*Departamento Técnico Administrativo del Medio Ambiente*-Administrative Technical Department of Environment) gives concessions to use water according to the provisions of the decree, while CAR (*Corporación Autónoma Regional de Cundinamarca*- Regional Autonomous Corporation of Cundinamarca) grants concessions in accordance with its own regulation, namely Accord (*Acuerdo*) of CAR 10 of 1989, which is resolved based on the decree.

(c) Law No. 99 of 1993

Law No. 99 of 1993 institutes organizations for public administration of environmental protection and conservation as well as renewable natural resources management, such as Ministry of Environment, National Council of Environment, Institute of Hydrology, Meteorology and Environmental Study, Regional Autonomous Corporations. The Law also provides duties and jurisdictions of the relevant organizations. The Law stipulates that Regional Autonomous Corporations with financial independence and their own properties administer environment and renewable natural resources according to the laws and polices of the Ministry.

Study Area, the Upper Bogotá River Basin, falls under the in the territory of CAR with a exception of the small area, which belong to the territory of the Regional Autonomous Corporation of Guavio, south to the Tomine Lake. In case an ecosystem or a water basin extends to territories of two or more regional autonomous corporations, there will be a join commission for coordinated management. In case of a large urban center with a population of one million or more, environmental authority of the local government of the area take same

functions as the regional autonomous corporation of the area with in the urban zone. The provision is applied in the Study Area, DAMA take the duties of the duty of environmental and renewable natural resources management.

The Law also provide financial resources for the managing entities, i.e., CAR, DAMA, etc., as i) charges for water use, ii) more than 1% of investment cost for the project of water intake from natural source, iii) some portion of property tax for real estate, iv) transfer of from electric sectors, etc.

(d) Law No. 373 of 1997

Law No. 373 of 1997 provides programs for efficient use and saving water. All municipalities shall elaborate five-year program in cooperation with entities of water supply, sewerage, irrigation, electrical generation etc., to be approved by respective regional autonomous corporation and to be submitted to the Ministry of Environment.

(e) Accord of CAR No. 8 of 2000

Accord of CAR No. 10 of 2000, determines water right charge. Basic charges by municipality are calculated taking account of factors on i) aridity, ii) unsatisfied basic necessity, as socio-economic conditions, iii) availability of water resources. Pressures on water resource potential, i.e., percentage of granted volume to half of mean discharge in dry seasons in case surface water and recharge in case of groundwater, is also a factor for the calculation. For groundwater the charge is lower when the depth of the well is deeper.

(f) Resolutions of DAMA on Groundwater Management

Resolution No. 250 of DAMA, 1997, determines formula to calculate rate for abstraction of groundwater. The resolution gives higher rate for shallow borehole less than a depth of 120m and 400m. The resolution No. 251 of 1997 gives obligation of registration of wells located in the Capital District to DAMA. According to DAMA, some 300 wells are registered. No. 815 of 1997 gives obligation of metering for well owners. The Resolution No. 1219 of 1998 stipulates payment of fee for groundwater use according to the volume of consumption.

(g) Recent Decrees on Water Basin Management

Decree No. 1604 of 2002 stipulate the members of the Joint Commission and its functions based on Law No. 99 of 1993. The members include directors, or their delegates, of regional autonomous corporation(s) and the environmental authority of the large urban center. Functions of the joint commission are coordinating activities on i) formulation of regulation and management plan of the water basin, ii) approval of the plan, iii) set up mechanism for the implementation of the plan, iii) implementation of programs of economic instruments. The Decree allows the commission to establish a technical commission for the support to carry out its functions.

Decree No. 1729 of the same year gives provisions of concept, objectives, compositions, implementation, and financing for the implementation of the regulation and management plan. The plan has a) diagnostic, b) prospective, c) formulation, d) implementation, and e) monitoring and evaluation phases.

(2) Current Conditions of Organizations Related to Water Resource Management

(a) Responsibility Assignment

According to the documents provided and interviews held during the first study period in Colombia, December 2000 to March 2001, the responsibilities assignment for water resource management can be summarized as shown in the table below.

Table- 3.10 Responsibility Assignment for Water Resources Management

	Min. Environ.	IDEAM	INGEO-MINAS	CAR	DAMA	EAAB	Others
POLICY FORMULATION							
Water Resources Assessment and Allocation							
*Surface Water	N			L	(L)		
*Groundwater	N			L	L		
Water Resources Development and Supply							
*Municipal Use						L	L
*Agricultural Use							N, L, P
*Industrial Use							P
*Others							P
Water Resources and Wetlands Conservation							
*Pollution Controls	N			L	L		
*Sewerage Development						L	
*Land Use Regulation	N			L	(L)		N, L
*Others	N			L	L		
WATER RESOURCES ASSESSMENT							
Measurement/Monitoring							
Surface Water							
*Quantity		N		L	L	L	L
*Quality		N		L	L	L	
Groundwater							
*Quantity		N	N	L	L		
*Quality		N	N	L	L		
Current Water Use and Future Demands							
*Municipal Use		N		(L)	(L)	L	L
*Agricultural Use							L
*Industrial Use							P
*Others							N,L
Evaluation							
*Surface Water		N		L	L	L	
*Groundwater		N	N	L	L	L	
WATER RESOURCES ALLOCATION							
Surface Water				L	(L)		
Groundwater				L	L		
WATER RESOURCES DEVELOPMENT AND SUPPLY							
Municipal Use						L	L
Agricultural Use							N, L, P
Industrial Use							P
Others							P
WATER RESOURCES AND WETLANDS CONSERVATION							
Pollution Controls				L	L		
Sewerage Development				L		L	
Land Use Regulation				(L)	(L)		L
Others				L	L	L	

(Note) N: National Level, L: Local Level, P: Private Level

(b) Ministry of Environment

Ministry of Environment is in charge of management of environment and renewable natural resources, such as water resources. The ministry formulates policies of the matters at national level, while regional entities, such as CAR or DAMA is in charge of policy formulation and implementation for the management for their jurisdictions.

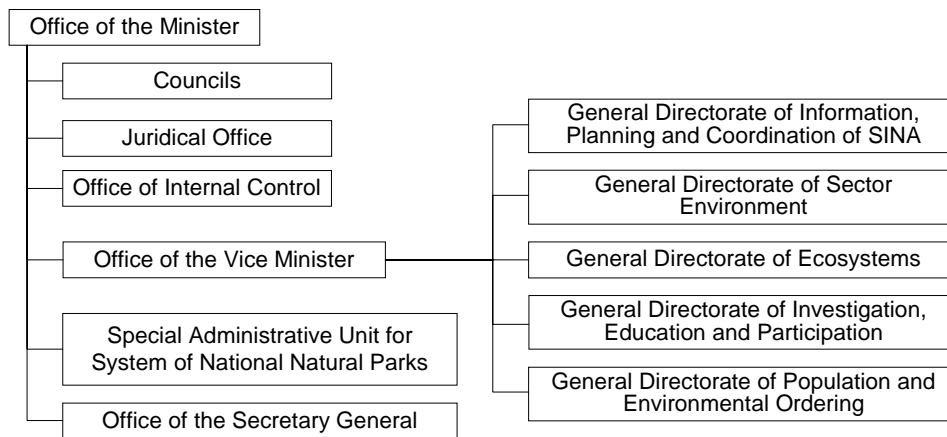


Figure- 3.10 Organization Chart of the Ministry of Environment

(c) CAR

CAR takes main role in environmental conservation and management of the renewable natural resources, including water resources. CAR was established as a water basin management entity and changed its name as the present one by the Law No. 99 of 1993. Its territory has also been changed from areas of basins to areas of administrative units. Since September 2002 CAR has been reducing the number of employees from nearly 870 to the half.

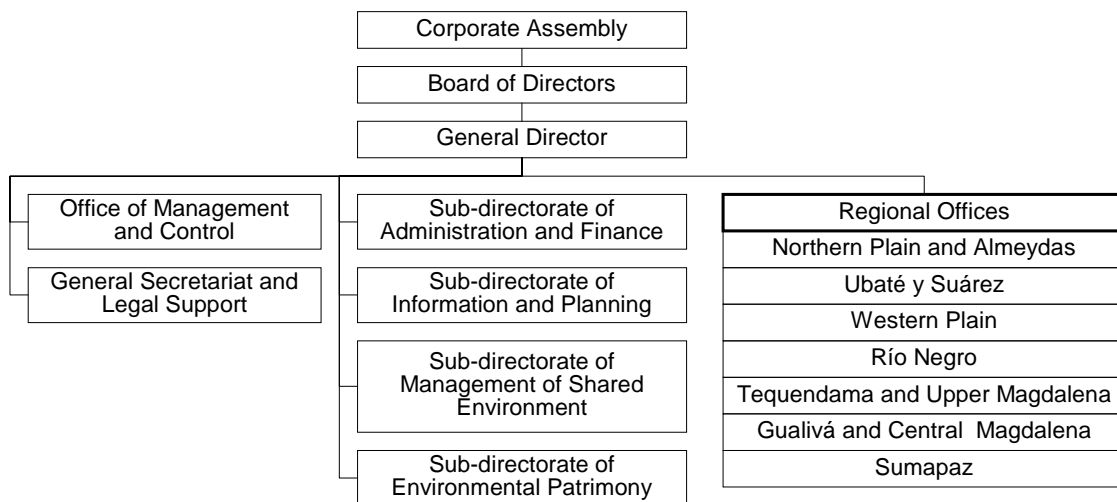


Figure- 3.11 Organization Chart of CAR

CAR is financially independent without any revenue form the national budget in recent years. In 2001, however, it received a small amount of budget transfer again from the national government. The revenue of the CAR in 2001 reached Col. \$78.3 billion, while the expenditure summed up to 103.3 Col. \$ billion, of which operational expenditure, debt service and investment expenditure were Col. \$ 36,1 billion, Col. 15.4 billion and Col. 51,9 billion, respectively.

The gap between approved and executed budget was large although it decreased to 10% of the approved for recurrent costs and 30% of that for investment costs in 2000. More than 60% of the actual expenditure is spent for investment in 2000.

(d) DAMA

DAMA is one of the Administrative Technical Department of the Government of Bogotá District

(*Alcaldia Mayor*) in charge of management of environment and renewable natural resources within the boundary of Bogotá D.C. In fact, however, DAMA grants water rights of groundwater only due to the limited availability of good quality of surface water in the area.

DAMA has posts of 156 persons as of 1999, of which more than 100 posts are at manager or professional levels. Since most projects are outsourced, DAMA has small number of employees at assistant or worker level.

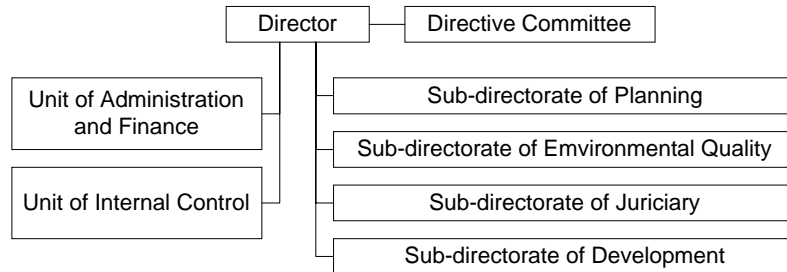


Figure- 3.12 Organization Chart of DAMA

(e) EAAB

EAAB (*Empresa de Acueducto y Alcantarillado de Bogotá-Bogotá Water Supply and Sewerage Company*) is a public company, without any private capital, in charge of water supply and sewerage services in Bogotá D.C. and water supply to some surrounding towns, such as Cajicá, Sopó, Tocancipá, La Calera, Gachancipá, Soacha, Funza, Mosquera, Madrid. EAAB has a plan to expand areas for the water supply service. EAAB is also engaged in environmental activities, such as implementation of wetlands conservation projects which are formulated by DAMA. Although EAAB is the counterpart entity for the Study, most of their water sources are surface water. EAAB employs around 2,100 persons. Revenue of EAAB in 2000 was Col. \$ 504 billion and its expenditure pf the same year was Col. \$ 551 billion.

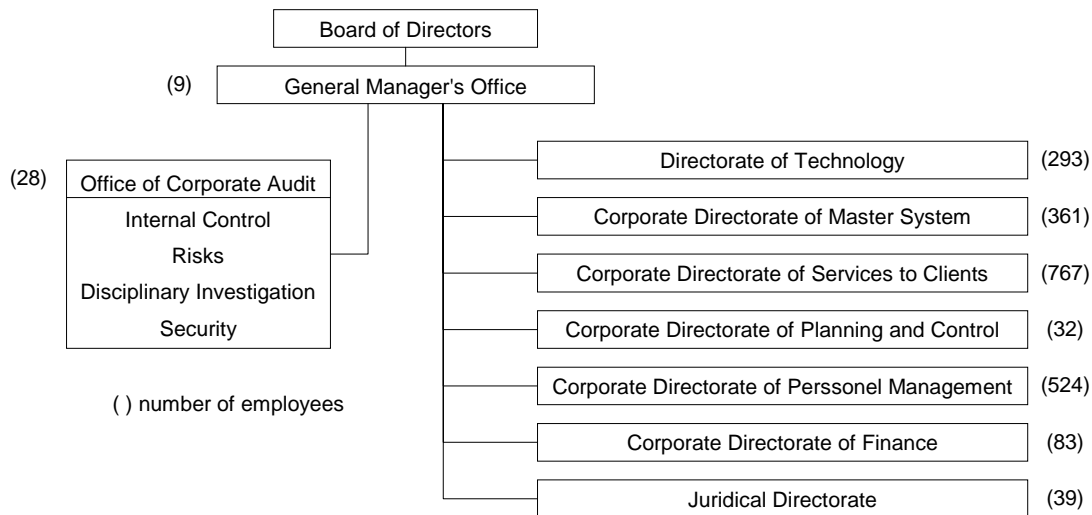


Figure- 3.13 Organization Chart of EAAB

(f) IDEAM

IDEAM (*Instituto de Hidrología, Meteorología y Estudios Ambientales-Institute of Hydrology, Meteorology and Environmental Study*) is in charge of environmental investigations, researches and studies for the policy formulation by the Ministry of Environment. IDEAM has employed of 557 persons. Although 705 posts are assigned to IDEAM, staffing has been planned to be implemented gradually and currently the Ministry of Finance approved 666 posts. A few persons are assigned for groundwater management.

(g) INGEOMINAS

INGEOMINAS (*Instituto de Investigación e Información Geocientífica, Minero- Ambiental y Nuclear*-Institute of Geo-scientific, Mining-Environmental, Nuclear Investigation and Information) is a technical center of geology or any matters related underground, including groundwater. Although INGEOMINAS has the following offices, sub-directorates and seven regional operation centers, investigations, researches and studies are conducted by project teams, so called functional groups, established for each project or programs. INGEOMINAS has staff of more than 600 persons, of which more than 100 persons are at levels of managers or professions.

(2) Current Status of Higher Education on Hydrogeology and the Professional Group

There are quite limited staffs who had higher education on groundwater in entities for groundwater management of Bogotá Plain. No staff of the entities has master degree on hydrogeology.

There are only two university is Bogotá which have courses on hydrogeology, National University and Andes University. Courses on hydrogeology for half a year are provided for students of civil, sanitary and environmental engineering, as a part of curriculum for hydrology, and part-time professors made lectures in both universities. In Andes University, a program on hydrogeology has been prepared in the hydrological course of master level. Only one student takes the program this year. According to the professors, many graduate got jobs not related to groundwater.

Establishment of an association of hydrogeologists is under preparation. Members of the association will be comprised of staff of consulting firms specialized for hydrogeology, professors of the universities, staff of CAR, DAMA, EAAB, IDEAM, INGEOMINAS, as well as drilling companies.

(3) Problems in Groundwater Management

Series of discussion meetings were held with counterparts from CAR, DAMA, Ministry of Environment, IDEAM, INGEOMINAS, Fundación Al Verde Vivo (environmental NGO) to identify problems in groundwater management after confirmation of responsibility assignments, self-evaluation of performances and procedure for granting rights to use groundwater. Various problems were raised at first. Then, problems were grouped into several clusters. The major problems and the structure; cause-result relations, can summarized as follows.

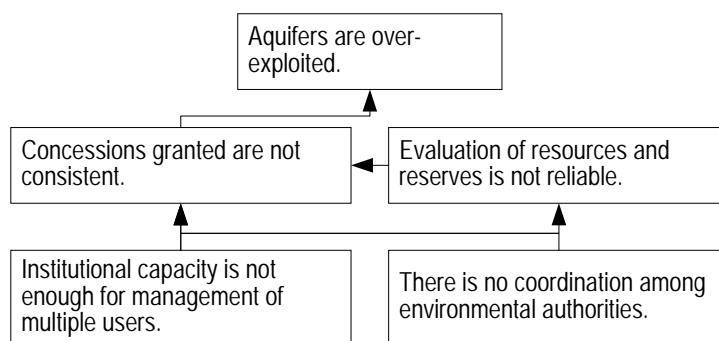


Figure- 3.14 Major Problems and their Cause-Result Relations

Detail problems and the relations regarding over-exploitation can be illustrated as follows:

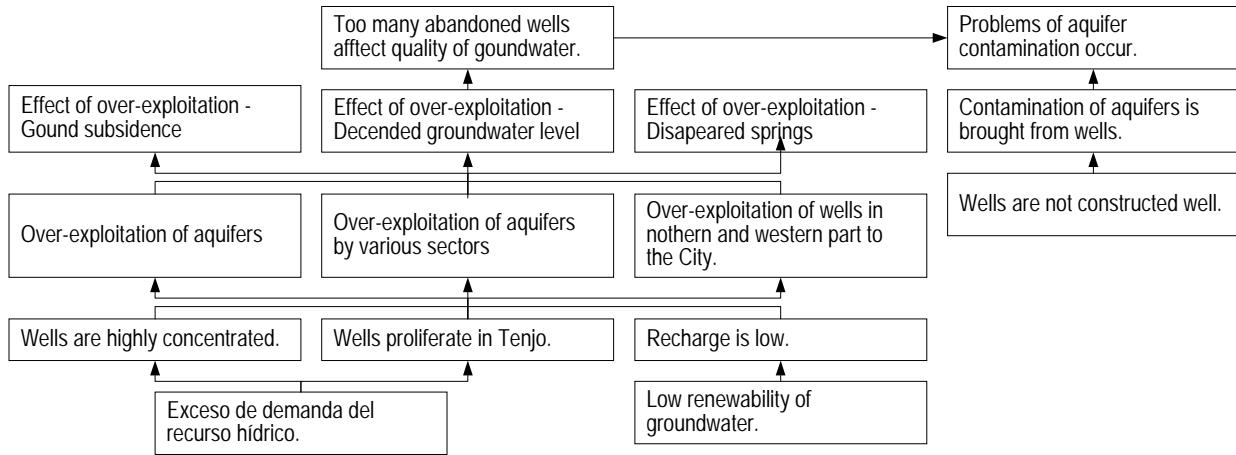


Figure- 3.15 Problems regarding Over-exploitation

Problems caused by as well as resulted to evaluation of groundwater potential and use can be structured as follows:

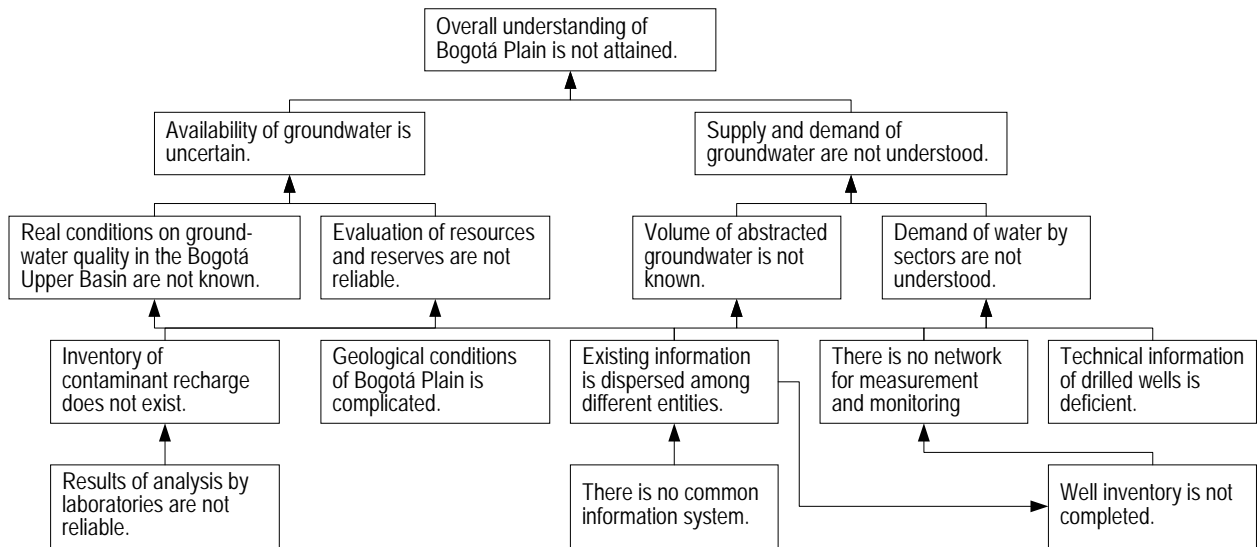


Figure- 3.16 Problems related to Evaluation

Problems related to institutional capacity are summarized as follows:

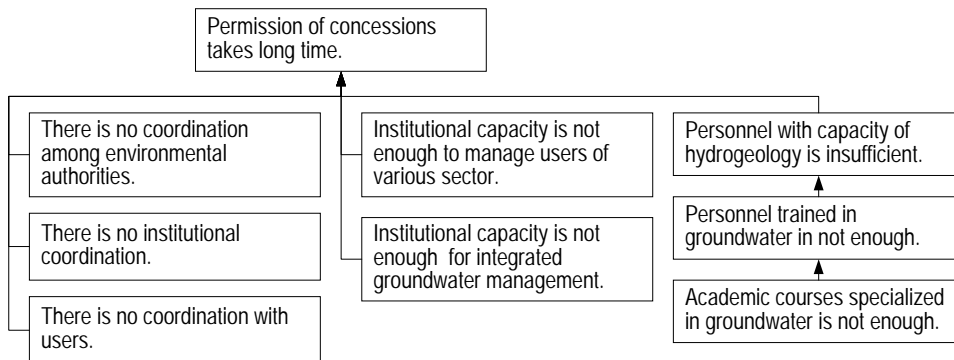


Figure- 3.17 Problems related to Institutional Capacity

Many problems were raised related to concession of rights to use water.

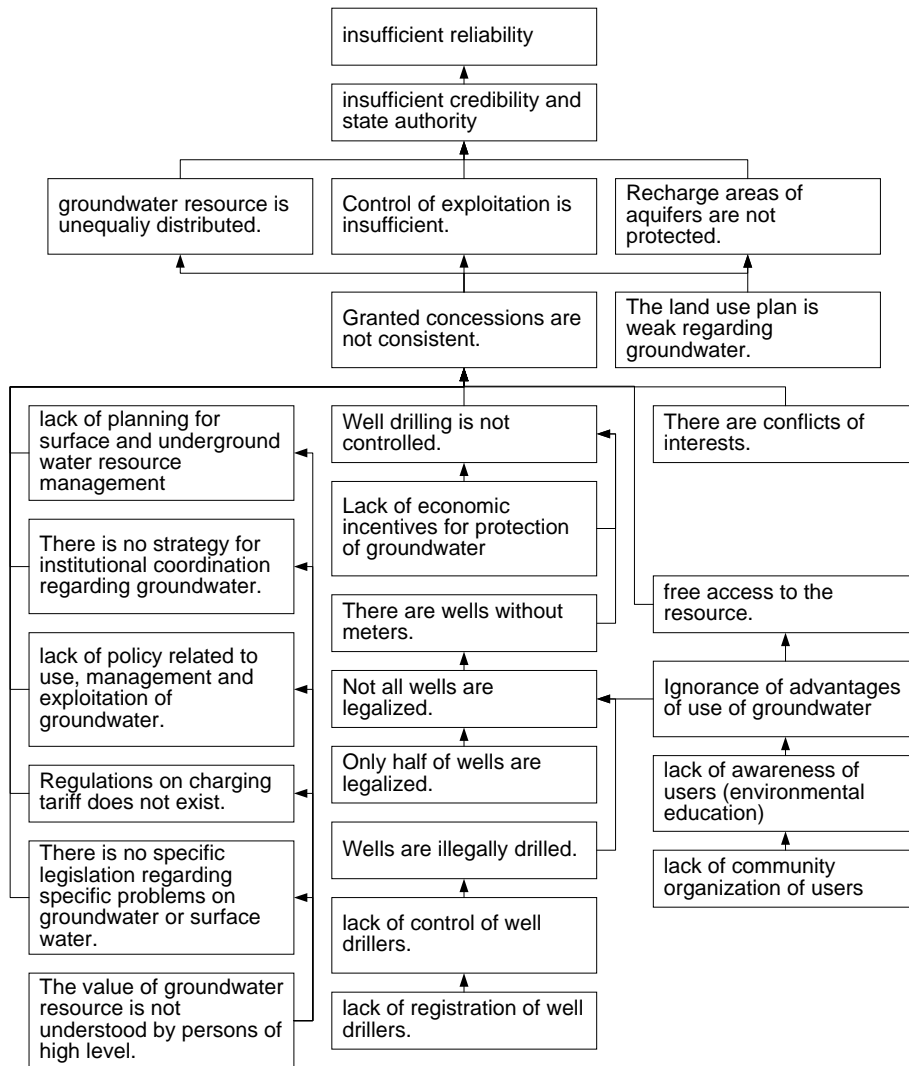


Figure- 3.18 Problems related to Water Right Concession