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Wetlands in Manzanillo

Factual Record regarding Submission SEM-09-002

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Abbreviations and acronyms

AIA	environmental impact approval
CEC	Commission for Environmental Cooperation
CFE	Federal Electricity Commission (*Comisión Federal de Electricidad*)
Cinvestav	Centro de Investigación y de Estudios Avanzados
Conabio	National Biodiversity Commission (*Comisión Nacional para el Conocimiento y Uso de la Biodiversidad*)
Conacyt	National Council of Science and Technology (*Consejo Nacional de Ciencia y Tecnología*)
DGIRA	Environmental Impact and Risk Branch (*Dirección General de Impacto y Riesgo Ambiental*) of Semarnat
DOF	Official Gazette of the Federation (*Diario Oficial de la Federación*)
EIS	environmental impact statement
JPAC	Joint Public Advisory Committee
LADSEC	Colima State Environment Act for Sustainable Development (*Ley Ambiental para el Desarrollo Sustentable del Estado de Colima*)
LGEEPA	Mexican Environmental Protection Act (*Ley General del Equilibrio Ecológico y la Protección al Ambiente*)
LGVS	General Wildlife Act (*Ley General de Vida Silvestre*)
NAAEC	North American Agreement on Environmental Cooperation
PDUM	Manzanillo Urban Development Plan (*Programa de Desarrollo Urbano de Manzanillo*)
POETEC	Colima State Ecological Zoning Plan (*Programa de Ordenamiento Ecológico del Territorio del Estado de Colima*)
PROETSLC	Regional Ecological Zoning Plan for the Cuyutlán Lagoon Subwatershed (*Programa Regional de Ordenamiento Ecológico Territorial de la Subcuenca de la Laguna de Cuyutlán*)
Profepa	Office of the Federal Attorney for Environmental Protection (*Procuraduría Federal de Protección al Ambiente*)
REIA	Environmental Impact Assessment Regulation to the LGEEPA (*Reglamento de la LGEEPA en Materia de Evaluación del Impacto Ambiental*
Semarnat	Ministry of the Environment and Natural Resources (*Secretaría de Medio Ambiente y Recursos Naturales*)
UGA	environmental management unit (*unidad de gestión ambiental*)

Abbreviations and definitions

Agreement	North American Agreement on Environmental Cooperation
AIA-LNG	Environmental Impact and Risk Approval for the project titled "Manzanillo Liquid Natural Gas Terminal," contained in file no. S.G.P.A./DGIRA/DG.0465.08 (11 February 2008), issued by the DGIRA to the Federal Electricity Commission
AIA-LPG	Environmental impact and risk approval for the project titled "LP Gas Supply Plant in the Municipality of Manzanillo, Colima, contained in file no. S.G.P.A./DGIRA/DEI.-1443.04 (23 June 2004), issued by the DGIRA to the company Zeta Gas del Pacífico, S.A. de C.V.
Colima	Free and Sovereign State of Colima
Council	Council of the Commission for Environmental Cooperation
Council Resolution	SEM-09-002 (*Wetlands in Manzanillo*), Council Resolution 14-06 instructing the Secretariat to prepare a factual record (8 July 2014)
EIS-LNG	Regional form of the environmental impact statement for the Manzanillo LNG Terminal project
EIS-LPG	Environmental impact statement for the LPG Terminal project
Guidelines	*Guidelines for Submissions on Enforcement Matters under Articles 14 and 15 of the North American Agreement on Environmental Cooperation*
LNG Terminal	Manzanillo Liquid Natural Gas Terminal, located on the Campos barrier island in Cuyutlán Lagoon, approximately 7 km south of the city of Manzanillo, to the southeast of the Manzanillo Thermal Power Complex
LPG or LP gas	liquid petroleum gas
LPG Terminal	Western Area LP Gas Receiving, Storage, and Distribution Terminal, located i n the municipality of Manzanillo, Colima at km 3.5 of the Manzanillo-Colima state highway, between Ejido de Campos and the locality of Cuyutlán
Mexico	United Mexican States
NOM-022	NOM-022-Semarnat-2003, *Establishing the specifications for the preservation, conservation, sustainable use, and restoration of coastal wetlands in mangrove zones*
NOM-059	NOM-059-Semarnat-2001, *Environmental Protection–Mexican native species of wild flora and fauna–Risk categories and specifications for their inclusion, exclusion or change–List of species at risk*
Notification	SEM-09-002 (*Wetlands in Manzanillo*) Article 15(1) Notification (19 August 2013)
Parties	The governments of Canada, the United States, and Mexico
Party	Government of Mexico
PEIA	Environmental Impact Assessment Procedure (*Procedimiento de Evaluación de Impacto Ambiental*)
Port terminals	The Manzanillo LPG Terminal and the LNG Terminal, taken together
Response	SEM-09-002 (*Wetlands in Manzanillo*), Party Response (12 October 2010)
Ramsar Convention	Convention on Wetlands of International Importance especially as Waterfowl Habitat
Secretariat	Secretariat of the Commission for Environmental Cooperation
Submission	SEM-09-002 (*Wetlands in Manzanillo*), Revised Article 14(1) Submission (2 November 2009)
Submitters	Bios Iguana, A.C., represented by Gabriel Martínez Campos, and Esperanza Salazar Zenil
Zeta Gas	Zeta Gas del Pacífico, S.A. de C.V.

Units of measure

°C	Degree Celsius
ha	hectare
km²	square kilometre
m	metre
mg/m³	milligrams per cubic meter
pH	hydrogen potential
pi³	Cubic feet
psu	practical salinity units
t	ton
µmol/l	micromoles (10^{-6} mole) per litre (measure of molar concentration)

Note of clarification

Due to the length of some of the Internet addresses referred to in this document, Google Shortener <http://goo.gl/> was used to abbreviate the URLs. In each case, the functionality of the corresponding link was checked and the viewing date is specified.

Maps and other illustrations included in this factual record were produced from available sources, are not to scale, and are purely for purposes of illustration.

Cuyutlan Lagoon.

Summary of Facts

Submission Date: 4 February 2009

Submitters: Bios Iguana, A.C., and Esperanza Salazar Zenil

Assertion: The alleged failure of the environmental impact assessment and authorization process for the Liquified Petroleum Gas (LPG Terminal) and Liquefied Natural Gas Terminal (LNG Terminal) projects in Manzanillo, Mexico.

Council Resolution: 8 July 2014, authorizing the Secretariat to develop a factual record

Scope of factual record: The consistency of the gas projects with applicable ecological zoning plans and the environmental impact assessment for the LNG Terminal project with respect to hydrodynamics in the coastal wetlands of Laguna de Cuyutlán.

Background: In February 2004, the company Zeta Gas del Pacífico, S.A de C.V. ("Zeta Gas") submitted an environmental impact statement (EIS) for the LPG Terminal project before the Environmental Impact and Risk Branch (*Dirección General de Impacto y Riesgo Ambiental*—DGIRA) of the Ministry of the Environment and Natural Resources (*Secretaría de Medio Ambiente y Recursos Naturales*—Semarnat). In November 2006, the Federal Electricity Commission (*Comisión Federal de Electricidad*—CFE) filed the EIS before DGIRA for the LNG Terminal project (see sections 1 and 2).

The Projects' relationship with the ecological zoning plans

At the time the EISs for both projects were submitted to the environmental authorities on 24 February 2004 (LPG Terminal) and 8 November 2006 (LNG Terminal), these did not appear to be consistent with applicable ecological zoning plans (see table 2). Subsequent to the EIS filings, local and state authorities modified the zoning plans so that the Projects were consistent with the authorized uses of the land. Additionally, the Mexican federal authority concluded that an applicable zoning plan was too general for placing applicable restrictions to the project. The Secretariat findings are summarized in more detail below.

a) Municipal level

Manzanillo Urban Development Program

LPG Terminal. The Secretariat found that, when the EIS was filed, the project did not appear to be consistent with the Manzanillo Urban Development Program (*Programa de Desarrollo Urbano de Manzanillo*—PDUM) published in October 2000, as the land was subject to forestry use and authorized only low-density ecotourism (paragraphs 39-41). The company Zeta Gas sought an amendment to the classification and zoning to carry out the project, while the EIS process was being carried out by DGIRA (paragraph 42). The Manzanillo city council approved the request on 14 May 2004, eleven days before DGIRA issued the environmental assessment authorization, converting the area into a medium-term urban reserve zoned for high-impact, high-risk heavy industry (paragraph 43).

LNG Terminal. With respect to the LNG Terminal, the land use authorized in the PDUM at the time the EIS was submitted was classified as forestry, with primary zoning for equipment and secondary zoning as green area, all of which appeared to be incompatible with the intended project activities (paragraph 47). The CFE and DGIRA both found that the LNG Terminal project would be located outside the Manzanillo city boundaries prescribed by PDUM 2000 (paragraph 45). After reviewing the PDUM the CEC Secretariat found that the Manzanillo LNG Terminal project site appeared to fall within the scope of the PDUM 2000 area because the project was within the Manzanillo city limits (paragraph 46). Six months after the environmental assessment authorization was issued, the State of Colima modified the municipal zoning through a "partial program" for the LNG Terminal project to make it consistent with authorized uses. (paragraph 50).

b. State level

Colima State Ecological Zoning Program
(*Programa de Ordenamiento Ecológico Territorial del Estado de Colima—POETEC*)

LPG and LNG Terminals. The POETEC was in force when the LPG and LNG environmental impact assessments were submitted (24 February 2004 and 8 November 2006, respectively), and it was not amended during the environmental impact assessment processs for either project, or before the respective authorizations were issued (June 2004 and February 2008, respectively). The zoning policies contemplated in POETEC 1993 for the areas and influence zones for the sites where both projects were carried out are *protection*, *use* and *conservation* (paragraphs 56-57). Upon evaluating the LPG Terminal, DGIRA stated that the POETEC was too general, as it had too "broad" a scale of analysis, and while the zone was defined with a protection policy, POETEC did not specify the compatible activities (paragraph 58). As regards the LNG Terminal, DGIRA considered that the project was consistent with the protection and conservation policies under POETEC, since "the opening of the access channel to the Cuyutlán lagoon through Tepalcates, will generate conditions that may be deemed optimal for the lagoon's environmental quality." The hydrodynamic studies supporting an improvement in the environmental quality of the Laguna de Cuyutlán, which were made a condition of the project's approval, were not completed by the project proponent and submitted to DGIRA' satisfaction for more than four years after the DGIRA authorization was issued (paragraph 59) and two and a half years after the project's dredging began.

c. Regional level

Regional Ecological Zoning Program for the Laguna de Cuyutlán Sub-Basin (*Programa Regional de Ordenamiento Ecológico Territorial de la Subcuenca de la Laguna de Cuyutlán—PROETSLC*)

LPG Terminal. The Secretariat found that the project, as presented in the submitted LPG Terminal EIS, did not appear to be compatible with the environmental management units (*Unidades de Gestión Ambiental*—UGAs), environmental policies and land uses applicable under the PROETSLC in effect at that time (24 February 2004) nor when the authorization was issued (23 June 2004). The UGAs applicable to the LPG Terminal project were classified as a "green space"; the applicable policies were for protection and conservation; and the compatible use was flora and fauna, while the conditioned use was low-impact tourism. Infrastructure was found to be an incompatible use (paragraphs 64 and 65 and Table 2).

LNG Terminal. The project did not appear to be compatible with PROETSLC when the EIS was submitted for authorization with DGIRA on 8 November 2006. The applicable policies defined in PROETSLC were conservation and protection and land use was restricted to agricultural activities. The areas were classified for fishing, flora and fauna and natural space. Industry and infrastructure were incompatible uses (paragraphs 67-69 and Table 2).

The PROETSLC was modified on 3 May 2007, before the LNG Terminal project authorization was issued (11 February 2008). The new version of the PROETSLC determined that the applicable use policy was for port usage and that infrastructure would be a use compatible with the project being authorized by DGIRA (paragraph 74 and Table 2).

The LNG Terminal project's impact on Laguna de Cuyutlán hydrodynamics

The Cuyutlán lagoon, the largest coastal wetland in the region between the National Marshlands (*Marismas Nacionales*, in the State of Nayarit), and central Guerrero in Mexico, and the fourth largest in the country, has an area of 38,884 hectares, measuring 37 km long and 6 km at its widest point (paragraphs 16 and 17). Coastal lagoons like Cuyutlán are distinguished by their connectivity, the control of their process through a balance between the land and sea influences, and their ecological stability determined by environmental variability.

Historic changes experienced by the Cuyutlán lagoon include (see Table A5-1 at Appendix 5): i) a reduction in freshwater contributions and an increase in sediment contributions, due to deforestation and erosion in the regional basin; ii) land-use changes that led to deforestation of extensive mangrove areas; iii) transformations in the local environmental system that have affected the lagoon's natural connection to the sea, now maintained artificially; iv) an improvement in the trophic state of the lagoon due to the opening of the Tepalcates channel, primarily at reservoirs II and III.

During the project planning phase, three design layouts were considered for the development of the project. In 2008, DGIRA issued the conditional authorization to the LNG Terminal project approving a layout that would require widening of the Tepalcates Canal to allow LNG tanker access into the Cuyutlán Lagoon. Among the conditions of the authorization was the preparation of a hydrodynamic study which was requested to support the finding that the widening of the entrance canal (i.e. the Tepalcates Canal) for the project would have a beneficial effect on the lagoon, studies which had been requested by DGIRA repeatedly during the evaluation procedure (paragraphs 90-93). The studies were submitted to DGIRA by the CFE on several occasions, but they did not meet the criteria prescribed by the authority. The Secretariat found a notice of the start of dredging work dated February 2010, yet the studies and reports that finally met the condition to prepare a hydrodynamic study were submitted between 2010 and 2012. On 27 June 2012, DGIRA determined that the condition regarding the hydrodynamic study was deemed met (paragraphs 97-100).

The Secretariat found that as a result of the Tepalcates Canal expansion to 250 m water circulation and water exchange in the Cuyutlán lagoon has increased, which—according to experts consulted by the Secretariat—will lead to improved water quality and the site's environmental quality accordingly. Even if waters still do not flow with ease in some sections of the lagoon, there are clear larger flood zones caused by the opening of the channel in 2014 (paragraphs 115–116 and Figure 12). To summarize, the Cuyutlán lagoon mangrove ecosystem has endured serious impacts and a reduction in its coverage due to hydrological disturbances, due to modifications to both the regional and local environmental system. According to experts consulted by the Secretariat, a strategy without the Tepalcates channel—and without further intervention—would result in a salt marsh of little biological or ecological value, with a reduced likelihood of providing ecosystem services to surrounding residents (paragraphs 117 and 120).

Figure 1: Location of the Cuyutlán Lagoon in Manzanillo

1. Background to the submission

1. Articles 14 and 15 of the North American Agreement on Environmental Cooperation (the "NAAEC" or the "Agreement")[1] provide for a process allowing any person or nongovernmental organization residing or established in Canada, the United States, or Mexico to file a submission with the Secretariat of the Commission for Environmental Cooperation (the "CEC Secretariat" or the "Secretariat") asserting that a Party to the NAAEC is failing to effectively enforce its environmental law. The CEC Secretariat initially considers submissions to determine whether they meet the criteria contained in NAAEC Article 14(1). When the Secretariat finds that a submission meets these criteria, it then determines, pursuant to the provisions of NAAEC Article 14(2), whether the submission merits a response from the concerned Party. In light of any response from the concerned Party, and in accordance with NAAEC Article 15(1), the Secretariat may notify the Council that the matter warrants the development of a factual record, providing its reasons for such recommendation. Where the Secretariat decides that the existence of certain circumstances precludes the preparation of a factual record, it then proceeds no further with the submission.[2] Where the Council of the CEC so resolves, by a two-thirds vote of its members, the Secretariat produces a factual record as instructed by Council.

IN BRIEF

The Submitters assert that Mexico is failing to effectively enforce its environmental law in connection with the environmental impact assessment and approval of two gas infrastructure projects.

2. On 4 February 2009, the organization Bios Iguana, A.C., represented by Gabriel Martínez Campos, and Esperanza Salazar Zenil (the "Submitters"), filed submission SEM-09-002 (*Wetlands in Manzanillo*) with the Secretariat in accordance with NAAEC Article 14(1).[3] On 9 October 2009, the Secretariat found that some assertions in the original submission did not meet all the eligibility requirements of Article 14(1) and notified the Submitters that they had thirty days in which to file a revised submission.[4] On 2 November 2009, the Submitters filed a revised version of the submission with the Secretariat in accordance with NAAEC Article 14(1).[5]

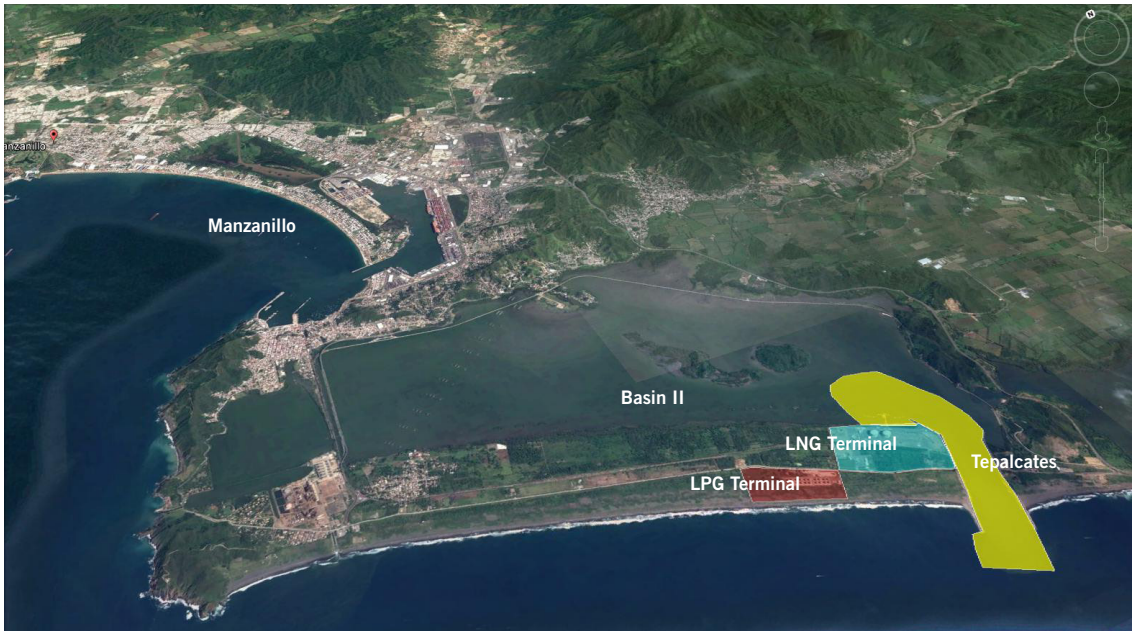
3. The Submitters assert that Mexico is failing to effectively enforce its environmental law in connection with the approved environmental impact assessment of two gas infrastructure projects currently in operation. These projects are "Western Area Liquefied Petroleum Gas (LPG) Receiving, Storage, and Distribution Terminal" ("LPG Terminal") and "Manzanillo Liquid Natural Gas Terminal" ("LNG Terminal") (together, the "port terminals"). These projects were evaluated and authorized between February and June 2004 (for the LGP Terminal) and November 2006 and January 2008 (for the LNG Terminal), as discussed in paragraph 34 . The Submitters assert that these projects are damaging Cuyutlán Lagoon in the state of Colima (see Figure 1); the lagoon, or wetlands in Manzanillo, is Mexico's fourth-largest coastal wetland and is the habitat for a large diversity of waterfowl birds (see section 3.1 *infra*). The Submitters further contend that both projects were granted environmental impact approval in violation of the applicable zoning and urban development plans.

4. On 11 October 2010, Mexico filed its response to submission SEM-09-002. The response asserts the alleged ineligibility of the submission, provides notice of the existence of pending proceedings in Mexico, and presents information in response to the Submitters' assertions.

5. After reviewing submission SEM-09-002 in the light of the Party's Response, the Secretariat notified the CEC Council on 19 August 2013 that it found the Submission to warrant the preparation of a factual record.[6] In its recommendation to Council, the Secretariat found that there were central open questions with respect to the modification of the municipal urban development programs applicable to the projects, the relationship of the gas projects to ecological zoning, and the enforcement of the environmental impact assessment provisions.[7]

6. On 8 July 2014, in Council Resolution 14-06, the Council unanimously instructed the Secretariat to prepare a factual record on submission SEM-09-002.[8]

Figure 2: Gas terminals in basin II of Cuyutlán Lagoon



Source: Google Earth

7. In accordance with Council Resolution 14-06, this factual record presents relevant factual information on the Submitters' assertions regarding the effective enforcement of environmental law provisions applicable to the relationship of the LPG Terminal and Manzanillo LNG Terminal projects to the ecological zonings plan and—as regards the environmental impact assessment for the LNG Terminal—to water flow in the Cuyutlán Lagoon coastal wetland (see Figure 2 and paragraph 13).

IN BRIEF

This factual record addresses:

- the relationship of the Liquefied Petroleum Gas (LPG) and Liquefied Natural Gas (LNG) Terminals to the ecological zoning plans, and
- the environmental impact assessment of the LNG terminal in relation to water flow in Cuyutlán Lagoon.

8. Canada and Mexico made public their reasons for approving the preparation of a factual record with a narrower scope from that which was recommended by the CEC Secretariat. The United States, for its part, stated that it "would also have supported a broader scope for the factual record."[9]

9. On 15 August 2014, the Secretariat sent a letter to the Government of Mexico through the Ministry of the Environment and Natural Resources (*Secretaría de Medio Ambiente y Recursos Naturales*—Semarnat),[10] requesting information on site cartography, the relationship between the projects and the environmental land-use plans and the hydrodynamic flow in the coastal wetland of the Cuyutlán Lagoon. The request for information was also sent to the branch offices of Semarnat[11] and the Office of the Federal Attorney for Environmental Protection (*Procuraduría Federal de Protección al Ambiente*—Profepa) in the state of Colima,[12] as well as to the Submitters.[13] In addition, the Secretariat sent requests to the companies Zeta Gas del Pacífico, S.A. de C.V.[14] ("Zeta Gas"), which operates the LPG Terminal and Terminal KMS de GNL de R.L. de C.V.,[15] in charge of operating the LNG Terminal for the Federal Electricity Commission (*Comisión Federal de Electricidad*—CFE) who also received a request.[16] The two latter companies declined to provide information,[17] while Zeta Gas did not reply. The Secretariat did receive a response to its request from the Legal Affairs Coordinating Unit (*Unidad Coordinadora de Asuntos Jurídicos*) from Semarnat, which sent a CD with photos and maps of the site in question.[18] No further information on the enforcement of the environmental law in question was received from either the authorities or the companies involved in the operation of the port terminals.

10. The information the Secretariat relied upon to prepare this factual record was obtained through public governmental information requests in accordance with Mexican law which were filed by Quetzalli Ramos,[19] a consultant retained by the Secretariat. Other consultants assisted the Secretariat in several sections of this factual record. These are: Erik Mellink (site recognition and identification of relevant information);[20] Rogelio Zizumbo-Villarreal (land use planning);[21] Jorge Herrera and Ismael Mariño-Tapia (hydrology)[22] and Arturo Keer[23] and Luisa Manzanares[24] (review of the draft factual record).

11. In accordance with Article 15(5) of the Agreement, on 16 February 2016 the Secretariat submitted the draft factual record to the CEC Council, commencing a period of 45 working days for the Parties to make observations on the accuracy of the document.[25]

12. On 22 April 2016, Mexico and Canada submitted their observations on the accuracy of the draft factual record. The US did not present comments to the draft. In accordance with Article 15(6) of the Agreement,[26] the Secretariat incorporated the pertinent observations into the final version of the factual record and on 7 June 2016[27] submitted it to Council for a vote in accordance with Article 15(7) of the Agreement.[28]]

Photo 1: Wetlands in Cuyutlán Lagoon

© Tom Riggle

Photo 2: LPG Terminal in Manzanillo

© Quiltsalad (Sally)

2. Scope of the factual record

13. This factual record, which presents information consistent with the scope approved by the Council in Resolution 14-06, addresses matters of the effective enforcement of the following provisions of environmental law:[29]

    a) Article 35 of the Mexican Environmental Protection Act (*Ley General del Equilibrio Ecológico y la Protección al Ambiente*—LGEEPA)[30] and Article 13 paragraph III of the Environmental Impact Assessment Regulation to the LGEEPA (*Reglamento de la LGEEPA en Materia de Evaluación del Impacto Ambiental*—REIA),[31] in connection with the alleged failure to establish the relationship of the LPG and LNG Terminal projects to the ecological zoning plans;
    b) LGEEPA Article 30 and Article 60 *ter* of the General Wildlife Act (*Ley General de Vida Silvestre*—LGVS),[32] as well as NOM-022, in connection with the environmental impact assessment of the LNG Terminal project specifically in relation to water flow in the Cuyutlán Lagoon coastal wetland.

14. The full text of Council Resolution 14-06 and that of the NAAEC Parties' reasons for authorizing the scope of the factual record are provided in Appendix 1. In addition, the text of LGEEPA Articles 30 and 35, LGVS Article 60 *ter*, REIA Article 13 paragraph III, and the relevant sections of NOM-022 are provided in Appendix 3 of this factual record.

3. Context

15. This section describes the general conditions of Cuyutlán Lagoon, the LPG Terminal, and the LNG Terminal.

3.1 Cuyutlán Lagoon

16. Cuyutlán Lagoon sits on the Pacific coast of Mexico south of the city of Manzanillo, in the state of Colima, Mexico (see Figure 1). It measures approximately 37 km long and 6 km wide at its widest point, covering an area of 38,884 ha[33] and represents 90% of the wetlands of the state of Colima.[34] See Table 1 below showing land use and vegetation breakdown in the area. Its distinctive geographical characteristic is that it is divided into four bodies of water (basin I, II, III, and IV) delimited by natural and artificial physical barriers[35] that regulate the hydrodynamic (motion of the water) and, in large measure, the spread of pollutants and sediment from one basin to another.[36] Appendix 5 of this factual record presents a more detailed description of these basins.

IN BRIEF

The area of Cuyutlán Lagoon is equivalent to that of 8,600 soccer fields or ten times the size of the Mexico City International Airport.

Basins III and IV were listed under the Ramsar Convention on 2 February 2011.

Table 1: Land use and vegetation in Cuyutlán Lagoon, by area

	1971		2005		2010		Gains-losses 1971–2005	Gains-losses 2005-2010
Class	ha	%	ha	%	ha	%	Net (+/–)	Net (+/–)
Anthropic development	935	2	1,606	4	1,689	4	671	83
Agriculture-livestock	14,791	38	16,465	42	16,248	42	1,674	–217
Other vegetation	11,036	28	9,835	25	9,946	26	–1,201	111
Without vegetation	858	2	263	1	268	1	–595	5
Mangrove ecosystem	2,986	8	1,195	3	1,194	3	–1,791	–1
Disturbed mangrove ecosystem	0	0	0	0	1	0	0	1
Other wetlands	3,078	8	4,207	10	2,932	8	949	–1,095
Bodies of water	5,200	13	5,493	14	6,606	17	293	1,113
Total	**38,884**	**100***	**38,884**	**100***	**38,884**	**100***		

Note: All figures rounded.
* The figure is close to 100% once rounding of decimals is taken into consideration.
Source: Silva *et al.* (2009), p. 12, Table 1: "Extensión del uso de la tierra y vegetación de la laguna de Cuyutlán" (see complete bibliographical reference in note 33 of this factual record)

17. Cuyutlán Lagoon is the country's fourth-largest coastal wetland and the largest one in the region between the National Marshlands (*Marismas Nacionales*, in the State of Nayarit), and central Guerrero.[37] In addition to being an important area for salt harvesting and small-scale fishing, Cuyutlán is a site with a great diversity of waterbirds. One characteristic of the lagoon is its varying depth and salinity from year to year, a result of fluctuating water flows. This variability affects fishing and salt harvesting activities as well as the waterbird communities in the lagoon. Artificial structures have affected water flows and internal circulation in the lagoon since the nineteenth century.[38]

18. A set of factors, including the presence of various bird species with protected status and others classified as threatened, as well as the fact that flora and fauna populations in the lagoon are important to the maintenance of the region's biological diversity, led to the designation of basins III and IV of Cuyutlán Lagoon as Wetlands of International Importance under the Convention on Wetlands of International Importance especially as Waterfowl Habitat ("Ramsar Convention").[39]

3.2 Manzanillo LPG Terminal

IN BRIEF

The construction of the LPG Terminal was a private initiative of Zeta Gas to meet the demand for LP gas on the Pacific coast and adjacent portions of western Mexico.

19. As described in the environmental impact assessment (EIS) for the project,[40] the LPG Terminal is a private development aimed at satisfying the demand for liquid petroleum gas ("LP gas" or LPG, generally propane or butane) in the Pacific coast states of Jalisco, Colima, Michoacán and the adjacent Bajío region of Mexico. The company Zeta Gas del Pacífico, S.A. de C.V. was in charge of building the port terminal for receiving, storage, and distribution of LP gas on land situated in Cuyutlán Lagoon. This terminal was designed to expand and modernize the region's LP gas distribution and marketing network.[41] The environmental impact statement (EIS) for the project was filed for assessment with the Environmental Impact and Risk Branch (*Dirección General de Impacto y Riesgo Ambiental*—DGIRA) of Semarnat on 24 February 2004. The LPG Terminal was given conditional approval on 23 July 2004.[42]

20. The LPG Terminal is located in the municipality of Manzanillo, Colima, at km 3.5 of the Manzanillo-Colima state highway between Ejido de Campos and the locality of Cuyutlán. The terminal, sited on premises measuring 49.4 ha, occupies a construction area of 15.6 ha and consists of a port terminal with 16 spherical LP gas storage tanks and four propane gas tanks with a capacity of 43,380 barrels each.[43] The plant has the capacity to process a total throughput of 45,000 t/month (559,000 barrels/month) of LP gas and to distribute 10,000 barrels per day, volumes sufficient to supply LP gas to Manzanillo and neighboring municipalities.[44] The LPG Terminal stores gas delivered through sea LP gas vessels which deliver the product in receipt valves installed over sea buoy. The valves connect to a submarine pipeline. LP Gas is then distributed by trucks.[45] The LPG Terminal was inaugurated on 12 May 2006.[46]

Photo 3: Shore birds in basin II of Cuyutlán Lagoon, with LNG tanks in the background

© Saturnino Hernández Mercado

Photo 4: LNG Tanks in basin II of Cuyutlán Lagoon

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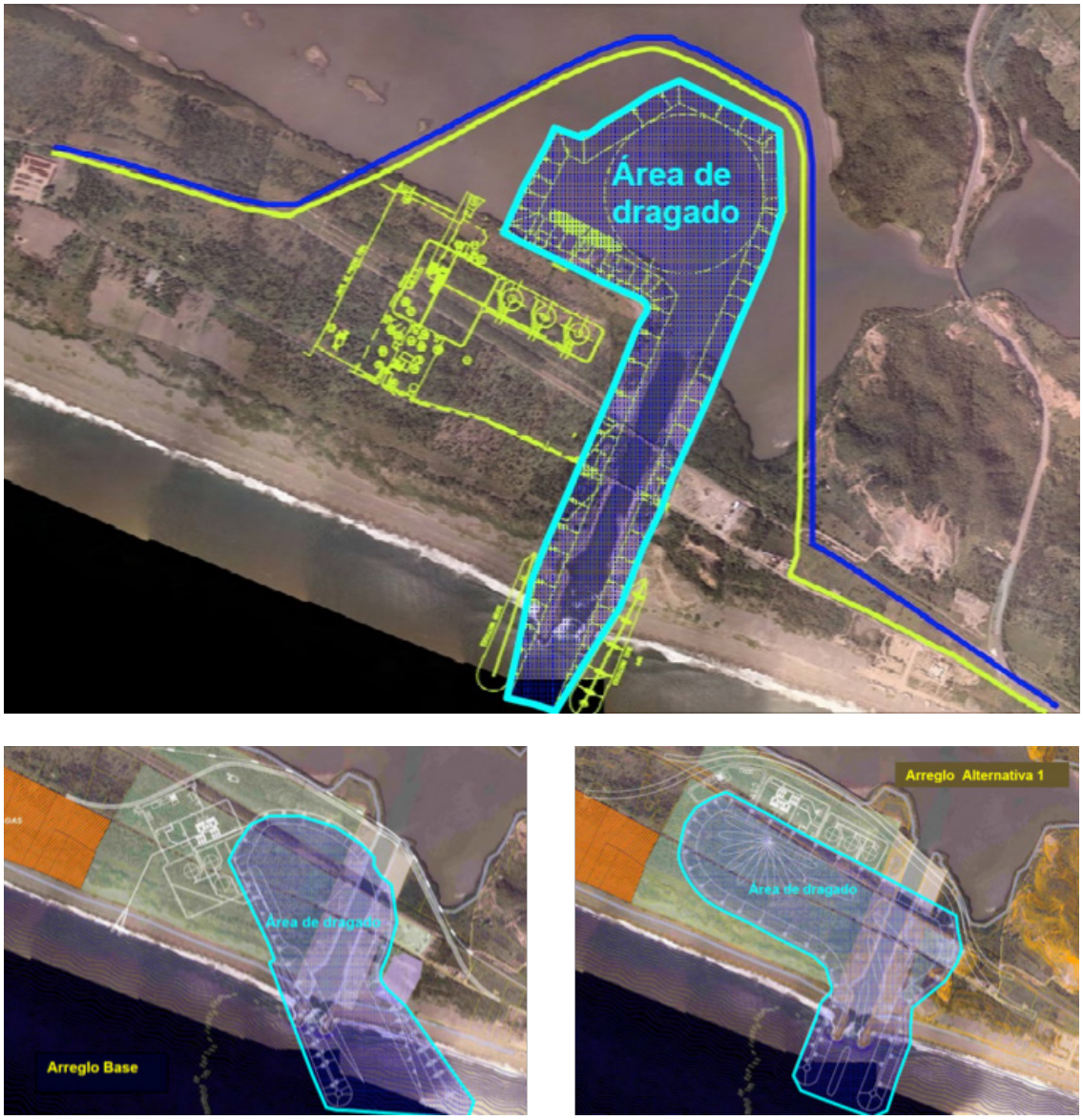
3.3 Manzanillo LNG Terminal

21. The LNG Terminal, developed by the CFE—a government-owned company—consists of a receiving, storage, and regasification terminal for liquid natural gas (LNG),[47] including three 165,000-m^3 LNG storage tanks with a daily regasification capacity of 1 billion cubic feet of natural gas.[48] The LNG Terminal was designed to supply natural gas to the Manzanillo Thermal Power Complex and the thermal power plants in the western-central region of the country.[49] The project EIS (EIS-LNG) contends that the facility will improve air quality in the Manzanillo area because the current coal-fired power plant in Manzanillo would be converted to a powered-gas co-generation facility.[50] Photo 4, taken in January 2010, shows in its background, the LNG Terminal tanks during construction.

22. The LNG Terminal is located on the sand bar of Ejido de Campos in Cuyutlán Lagoon, approximately 7 km south of the city of Manzanillo and southeast of the Manzanillo Thermal Power Complex. Adjacent to the Tepalcates Canal, the LNG Terminal is situated on federal, ejido, and private land.

23. During the project planning phase, three design layouts were considered within the EIS: Basic Layout, Alternative Layout 1, and Alternative Layout 2 (Omega)—all of which are shown in Figure 3. The three layouts comprised two project phases: i) a first phase in which there would be a terminal with daily production capacity of 500 million cubic feet and two 165,000-m^3 LNG storage tanks; ii) a second phase involving the installation of a third storage tank of equal capacity, in which daily production would increase to 1 billion cubic feet. Among the alternative models proposed in the EIS, the alternative approved by the DGIRA was Alternative Layout 2 (Omega).[51] All three alternatives involved widening the Tepalcates Canal to incorporate it into the terminal's water access areas, which would accommodate LNG tanker access. However, in the selected layout, the turning basin and the docking facility would be built inside basin II of Cuyutlán Lagoon. In addition, the engineering for Alternative 2 (Omega) includes diversion of the highway and the rail line.[52] The LNG Terminal was inaugurated on 27 March 2012.[53]

Figure 3: Selected layout for the LNG Terminal and alternative layouts



Source: Images taken from EIS-LNG (see complete bibliographical reference in note 36 of the factual record).

Above: The selected layout for the LNG Terminal (Alternative Layout 2 Omega).

Below: Basic Layout and Alternative Layout. Areas shaded in blue show the dredging for the three layouts. The project includes the following works: docking facility, canal, turning basin, breakwaters, embankment for relocation of a section of highway and railway and hydraulic control of lagoon flooding caused by ocean influences, aqueducts, installation of a gas pipeline segment and a cold water line.

4 Actions taken by Mexico to effectively enforce LGEEPA Article 35 and REIA Article 13 paragraph III in connection with the alleged failure to relate the LPG Terminal and LNG Terminal projects to the ecological zoning plan

4.1 Submitters' assertions

IN BRIEF

The submitters assert that the Manzanillo Urban Development Plan (PDUM) was amended "nearly four months after Zeta Gas del Pacífico filed the EIS with Semarnat."

24. With respect to the first issue authorized by the Council to be assessed in this factual record, the Submitters assert that Mexico is failing to effectively enforce LGEEPA Article 35 and REIA Article 13 paragraph III in relation to the LPG Terminal and LNG Terminal projects; contending that neither project was consistent with land use plans at the time of the Projects' environmental impact assessments.[54]

25. The Submitters assert that the statement in the LPG Terminal project EIS (EIS-LPG) to the effect that "there does not exist any specific regional ecological zoning encompassing the project site"[55] is incorrect because it does not correspond to the situation at the filing of the EIS. [56]

26. The Submitters state that the EIS-LPG was submitted for assessment on 24 February 2004, when the Regional Ecological Zoning Plan for the Cuyutlán Lagoon Subwatershed (*Programa Regional de Ordenamiento Ecológico Territorial de la Subcuenca de la Laguna de Cuyutlán*—PROETSLC) was in force.[57]

27. The Submitters also assert that the Manzanillo Urban Development Plan (*Programa de Desarrollo Urbano de Manzanillo*—PDUM) was amended "nearly four months after Zeta Gas del Pacífico filed the EIS with Semarnat"[58] and that the DGIRA did not consider this fact when approving the LPG Terminal project. They contend that the project was approved nonetheless and that even the environmental impact approval (AIA) clearly indicated that the project conflicted with the land use policies and corresponding zoning.[59]

28. The Submitters also state that the LPG Terminal project is incompatible with the environmental management units (*unidades de gestión ambiental*—UGA) defined in the PROETSLC that are applicable to the project areas. These areas, they maintain, are covered by conservation and protection policies with which infrastructure works are incompatible.[60] Environmental management units are the minimal zoning territory in which guidelines and ecological strategies can be designated; these normally have codes for their identification.[61]

29. Concerning the LNG Terminal project, the Submitters contend that the EIS "does not establish the relationship to the planning instruments and the applicable legal instruments."[62] The Submitters state that the EIS does not consider the project relationship with the applicable legal instruments and that this relationship was only considered after the state of Colima amended the PROETSLC during the project assessment process. In the Submitters' judgment, this situation epitomizes the failure to effectively enforce REIA Article 13 paragraph III.[63] The submission further states that the PROETSLC amendment "consisted in changing from UGAs that establish conservation, protection, and restoration policies to UGAs conferring industrial and port status," precisely corresponding to the area where the LPG Terminal and LNG Terminal projects are sited.[64]

4.2 Environmental law in question

30. LGEEPA Article 35 provides that, for an environmental impact assessment, Semarnat shall adhere to the provisions of the laws, including the applicable urban development and ecological zoning plans:

> **Article 35**. Upon the filing of an environmental impact statement, the Ministry shall initiate the assessment procedure, for which purpose it shall verify that the application meets the formalities prescribed by this Act, its Regulation, and the applicable Mexican official standards, and shall open the corresponding file within a period not to exceed ten days.
>
> For the approval of the works and activities to which Article 28 refers, the Ministry shall adhere to the provisions of the aforementioned instruments as well as the urban development and ecological zoning plans, protected natural area declarations, and any other legal provisions that may be applicable.

31. For certain types of projects and depending on its anticipated environmental impact, an EIA must also include a regional analysis.[65] Environmental Impact Regulation Article 13 paragraph III implements LGEEPA article 35 as it provides that a regional environmental impact statement shall make explicit reference to "the applicable planning instruments and legal provisions"

32. LGEEPA Article 35 has not been amended since the filing of submission SEM-09-002. Its most recent revision corresponds to an executive order published in the Official Gazette of the Federation (*Diario Oficial de la Federación*—DOF) on 13 December 1996. As regards REIA Article 13 paragraph III, it has not been revised since its publication on 30 May 2000.

33. Seeking an environmental impact authorization from federal authorities is governed by the Environmental Impact Assessment Procedure (*Procedimiento de Evaluación del Impacto Ambiental*—PEIA). The PEIA commences with the filing of an EIS in which the party wishing to execute a project—the "developer," as this party is commonly designated—gives notice, "based on studies, of the significant potential environmental impact that would be caused by a work or activity, as well as the manner in which any negative impacts are to be prevented or mitigated."[66] The PEIA is the mechanism whereby Semarnat "places conditions on the execution of works and activities that may cause ecological instability or exceed the limits and conditions set out in the provisions applicable to the protection of the environment and the preservation and restoration of ecosystems, with a view to preventing or minimizing their negative effects on the environment."[67]

Photo 5: Wildlife in Basin III, Cuyutlán Lagoon

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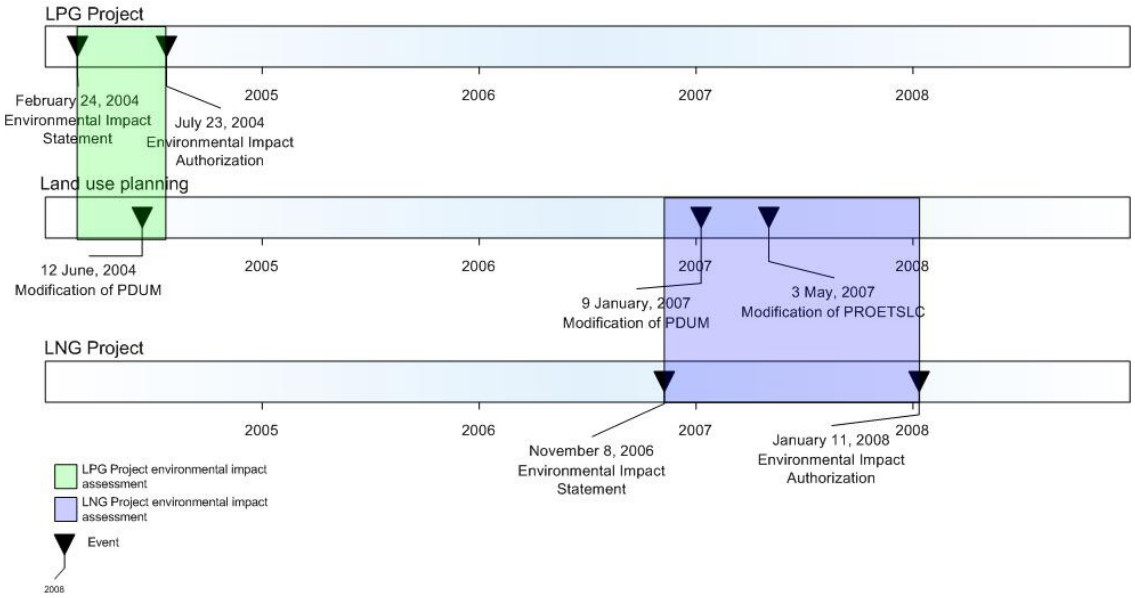
34. Figure 4 presents the critical events in the EIS authorization process in connection with land use modification. It shows that after the filing of EIS applications for both projects, the applicable land use programs were modified. The reader may also refer to Table 2 which shows the main land use classifications applicable to both LNG and LPG project that were in force at the moment their respective EIS was filed and authorized.

Figure 4: Critical Land Use Planning Events in the Environmental Impact Authorization Process



4.3 Mexico's response regarding the enforcement of LGEEPA Article 35, second paragraph, and REIA Article 13 paragraph III in connection with the port terminal projects

35. Mexico responded —through Semarnat's Legal Affairs Coordinating Unit —that DGIRA office effectively enforced LGEEPA Article 35, second paragraph, and REIA Article 13 paragraph III, in connection with both projects It stated that the EIS explains the project's relationship to the applicable legal provisions, including the "local and regional ecological zoning," and that the DGIRA adhered to the applicable plans when it approved the projects.[68]

IN BRIEF

Information in Mexico's response stated that the DGIRA office determined the LPG project inside Manzanillo city boundaries, while it considered the LNG project outside the city. As a result, DGIRA decided that the PDUM was applicable only to the LPG Terminal project.

36. The Party adds that in the approval for the AIA-LPG, the DGIRA analyzed the project's viability with respect to the Colima State Ecological Zoning Plan (*Programa de Ordenamiento Ecológico del Territorio del Estado de Colima*—POETEC), the PROETSLC, and the PDUM,[69] and reached the conclusion that the LPG Terminal project "is not incompatible with the land use policies established in the applicable ordinances or legal instruments."[70] Mexico states that the DGIRA "included in its assessment a consideration of the project's relationship to the zoning and land use planning instruments applicable in the region."[71] It further states that on 18 May 2004 the company, Zeta Gas, in response to a request from the DGIRA, submitted information that "situated its project within the PDUM, stating that the applicable land use classification in the PDUM was 'forested area with low-density ecotourism.'"[72]

37. In relation to the LNG Terminal project, Mexico asserts that, based on the review of chapter III of the EIS-LNG and of the additional information submitted by the CFE, the relationship to various instruments, including the PROETSLC, was in fact established.[73] Mexico contends that DGIRA requested that CFE provide "additional information concerning the relationship between the project works and activities and the order amending the PROETSLC,"[74] and that —upon responding to DGIRA—the environmental impact approval for the LNG Terminal (AIA-LNG) did take the additional information requested into consideration.[75] The

response states that the project was located in an area designated for industry and service use (39, A, A, Ei); restoration for conservation, natural space without the presence of oak forest or moist deciduous forest (47 R, Rc, Ent2), and conservation, natural coastal space with limited activities and low-impact ecotourism (41 C, C EncLe), and that these are consistent with the PROETSLC.[76] The reader may also see the discussion on UGAs at paragraph 28 above.

4.4 Relationship of the projects with ecological land zoning

38. This factual record addresses enforcement of the law in question by disclosing the applicable zoning plans in place during the environmental review process for each project, i.e PDUM (Municipal), POETEC (State) and PROETSLC (regional). The Secretariat consulted with Dr. Rogelio Zizumbo-Villarreal, who provided information on the scope and applicability of said programs to the projects in question.[77] Table 2 below presents the Secretariat's key findings in this respect.

Table 2: Main land use policies and areas classification in the land use plans applicable to the gas projects

LPG Manzanillo

	Allowed uses at EIS LPG filing (24 February 2004)				Allowed uses at AIA LPG (23 July 2004)
PDUM	Forested area (AR-FOR) Low density ecotourism (TE)				medium-term urban reserve (RU-MP) heavy industry and high-impact, high-risk zoning (I3)
POETEC	Zoning policies for protection, use, and conservation				No changes
PROETSLC	UGA Ag326 Ff417 Ent539 Ent440	Applicable policies Use Protection Protection Conservation	Compatible uses Livestock ENT* Flora and fauna Flora and fauna	Incompatible uses Infrastructure Mining Infrastructure Infrastructure	No changes

LNG Terminal

	Allowed uses at EIS LNG filing (8 November 2006)				Allowed uses at AIA LNG (11 January 2008)		
PDUM	Forested area (AR-FOR) Green space (EV) Pisciculture area				DGIRA considered that the Project is located outside the city of Manzanillo (See discussion on paragraphs 45-46)		
POETEC	Zoning policies for protection, use, and conservation				No changes		
PROETSLC	UGA If342 Ac431 Ag326 Ff443 Ent539 Ent440 Ff417	Applicable policies Use Use Use Use Protection Conservation Protection	Compatible uses Fishing Equipment Livestock ENT* Flora and fauna Flora and fauna ENT*	Incompatible uses Industry, aquaculture Infrastructure Infrastructure Infrastructure Infrastructure Infrastructure Mining	UGA 39 A Ei 41 C EncLe 26 A Apc 47 Rc EntLfe	Applicable policies Use Conservation Port Restoration	Compatible uses Infrastructure Infrastructure Infrastructure Infrastructure

*ENT. Terrestrial natural space

4.4.1 Land uses designated for the LPG Terminal, per PDUM 2000

39. The PDUM 2000—formerly called City of Manzanillo, Colima Urban Development Masterplan—was adopted by the Manzanillo city council on 18 September 2000 and published in the Official Gazette of the State of Colima (*El Estado de Colima, Periódico Oficial del Gobierno Constitucional*) on 4 November 2000. The PDUM 2000 arose from an adaptation of the Masterplan published in August 1993. The PDUM 2000 objectives focused on four aspects: establishing consistency with higher-order planning instruments; integrating the development of Manzanillo with the pace of national urban development; devising a comprehensive, balanced zoning system for the metropolitan area; and defining the existing urban area and the area that will be required in the short, medium, and long term.[78] The PDUM 2000 was in force at the time the EIS for each project was filed with the DGIRA for assessment.

40. In accordance with the PDUM 2000, the site where both projects were developed was classified, at the time of filing of the EIS for each of them, as a "conservation" area.

IN BRIEF

When the EIS-LPG was filed with the DGIRA, the PDUM 2000 classified the project area as a forested area zoned for low-density ecotourism. The City subsequently amended PDUM 2000 that allowed land use needs for the Project.

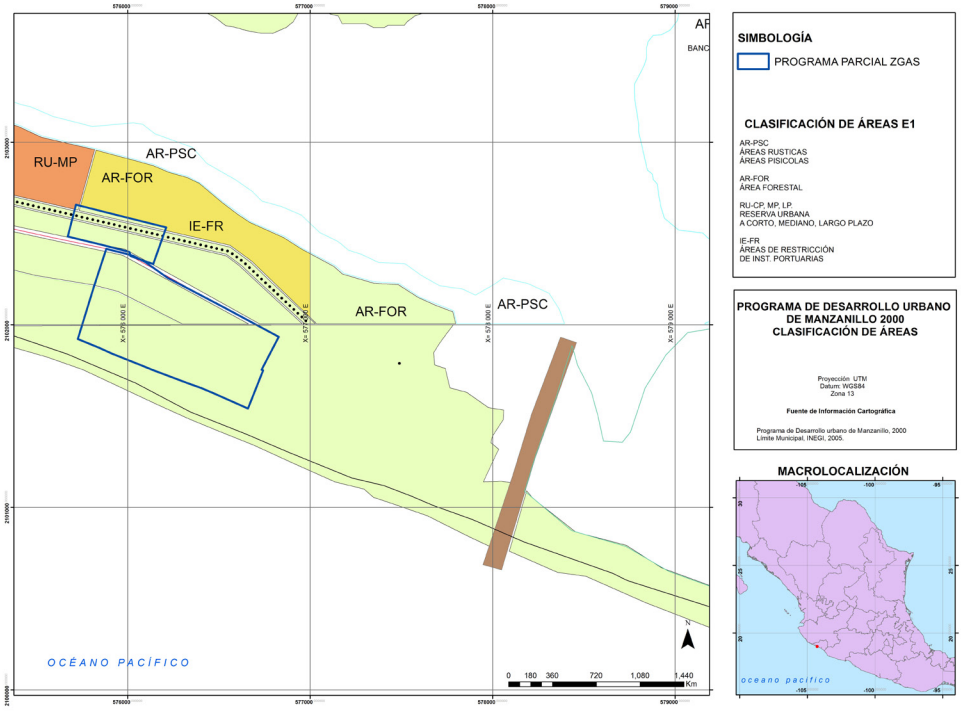
41. Figure 5 shows that, at the time of filing of the EIS-LPG for review by the DGIRA, the PDUM 2000 classified the project area as a forested area (AR-FOR). Similarly, Figure 6 shows that the area's primary zoning is for tourism and its secondary zoning is for low-density ecotourism (TH-2). The predominant use in this zone is mixed temporary housing, whereas the compatible land uses are restricted temporary housing, commerce and basic services, and outdoor leisure and recreation centers. The conditional use, governed by restrictions, was for single-family dwellings. Incompatible uses on the project site include natural resource exploitation, agriculture and livestock, higher-impact commercial and service activities, warehousing and storage, manufacturing and industry (low-, medium-, and high-impact), urban and regional equipment, specialized equipment, and infrastructure.[79]

42. While the DGIRA assessment of the EIS-LPG was in progress—the EIS was filed on February 2004—on 12 March 2004 Zeta Gas applied to the Manzanillo city council for a zoning variance covering the land occupied by the project site. On 14 May 2004, in regular council session, the city changed the plan and reclassified the area. As a result that the site was reclassified from a forested area (AR-FOR) to a medium-term urban reserve (RU-MP), while the project site was rezoned from ecotourism (TE) to high-impact, high-risk heavy industry (I3).[80]

43. The Manzanillo city council decision was published in the Official Gazette of the State of Colima on 12 June 2004. Eleven days later, on 23 June 2004, the DGIRA issued an environmental impact and risk decision granting approval for the LPG Terminal project to Zeta Gas del Pacífico, adding that the project "does not contravene land use policies".[81]

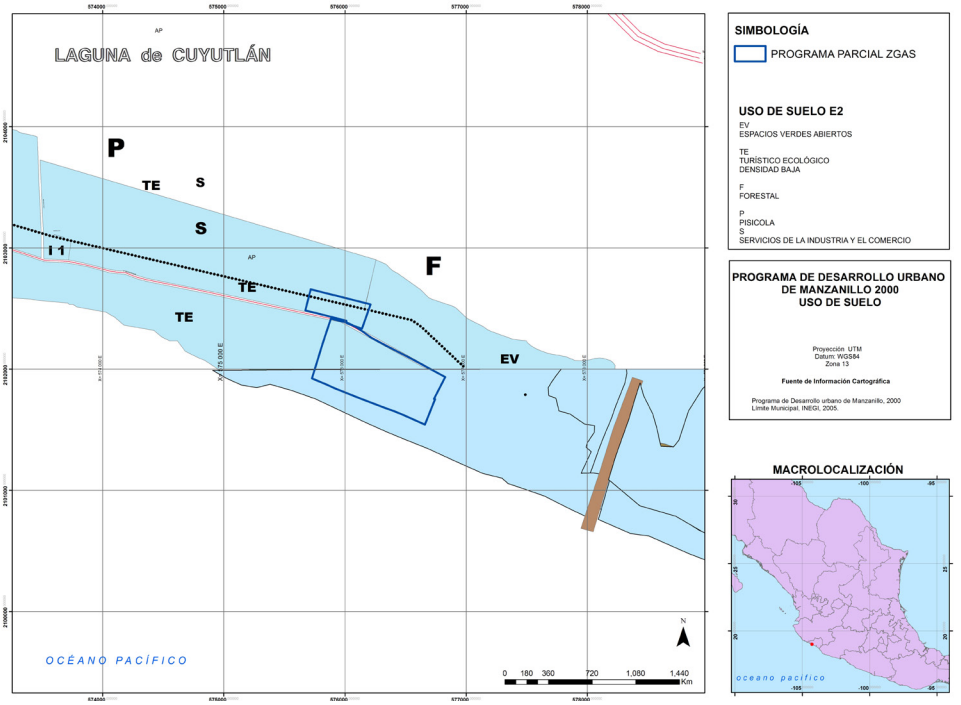
44. Subsequent to the PDUM 2000 amendment and the issuance of the AIA-LPG, the State of Colima issued a partial urbanization program which confirms the same land use classification for the LPG Terminal. The "Storage Terminal in the Form of an LP Gas Supply Plant" was published in the Official Gazette of the State of Colima on 30 October 2004. The plan reiterates the heavy industry and high-impact, high-risk zoning, lays down specifications for any structures to be built, and sets technical criteria for drinking water, drainage, and electrification.[82]

Figure 5: Designation of the LPG Terminal areas in the PDUM 2000



Source: PDUM 2000; municipal limits: INEGI, 2005.

Figure 6: Land use in the LPG Terminal area, per PDUM 2000



Source: PDUM 2000; municipal limits: INEGI, 2005.

4.4.2 Land uses designated for the LNG Terminal, per PDUM 2000

45. The EIS-LNG states that for two of the alternatives under consideration (Basic Layout and Alternative Layout 1), the PDUM 2000 was applicable to only an area of 6.83 ha or 3.8% of the area devoted to these options, whereas for a third alternative, Alternative Layout 2 (Omega), the entire project was outside the Manzanillo population center limits.[83] When issuing the environmental impact for the Alternative Layout 2 (Omega), DGIRA further found in its February 2008 authorization that the PDUM 2000 did not apply to this alternative:

> Concerning the application of the City of Manzanillo Urban Development Masterplan … it was determined that … "Alternative Layout 2 (Omega)" lies outside the coverage of that ordinance.[84]

46. The CEC Secretariat reviewed documents related to the PDUM, including figures and annexes. Information in the PDUM confirms that all the LNG Terminal areas are located inside the 28-vertex polygon delimiting the Manzanillo population center appearing on the PDUM 2000 land use map (see Figure 7).[85]

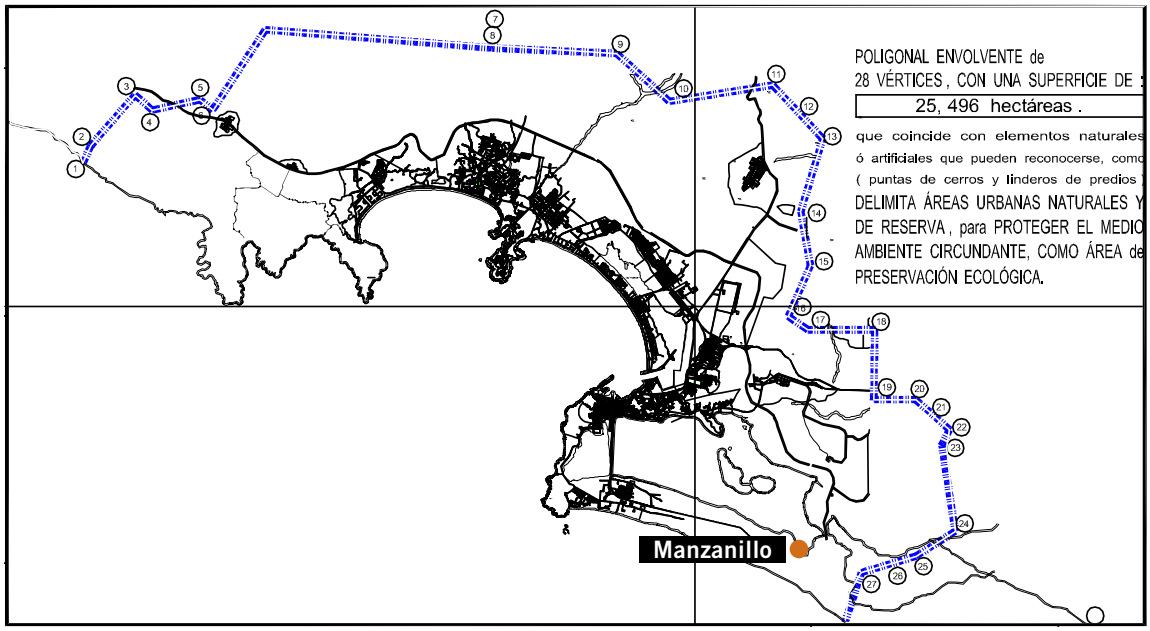
47. In the PDUM 2000, the area occupied by the LNG Terminal is classified as a forested area (AR FOR) (see Figure 8). Also, the primary zoning of the site is for urban furniture (such as benches or lighting), whereas the secondary zoning is for green space (EV). The predominant land use is designated as outdoor recreation. The rest of the uses contemplated in the PDUM 2000—including natural resource use, agriculture and livestock, habitation, infrastructure, manufacturing and industry, warehousing and storage, offices, commercial and service activities—are not compatible with the forested area (AR FOR) designation.

48. As regards the strip of the lagoon bank populated by mangroves that faced Cuyutlán Lagoon and the project dredging area, the PDUM 2000 classified it as a pisciculture area (see Figure 8), and the lagoon strip is designated for use as a forested area. According to the table of uses in the PDUM 2000, the predominant land use in a forested area is forestry; the compatible use is isolated housing, and the conditional uses are restricted temporary housing and mixed temporary housing. The other uses, including urban furniture, manufacturing and industry, warehousing and storage, offices, commercial and service activities, and agriculture and livestock, are incompatible. For the pisciculture area, the predominant use is pisciculture and the other uses are incompatible (Figure 9).

49. The AIA-LNG notes that on 10 January 2007 the Manzanillo city council "authorized the modification to the urban development program modifying the land use related to the Project."[86] After an exhaustive search by the Secretariat, it was not possible to confirm the specific type of land use authorized for the LNG Terminal. The AIA-LNG subsequently states, however, that the LNG Terminal "lies outside the coverage of [the PDUM]."[87]

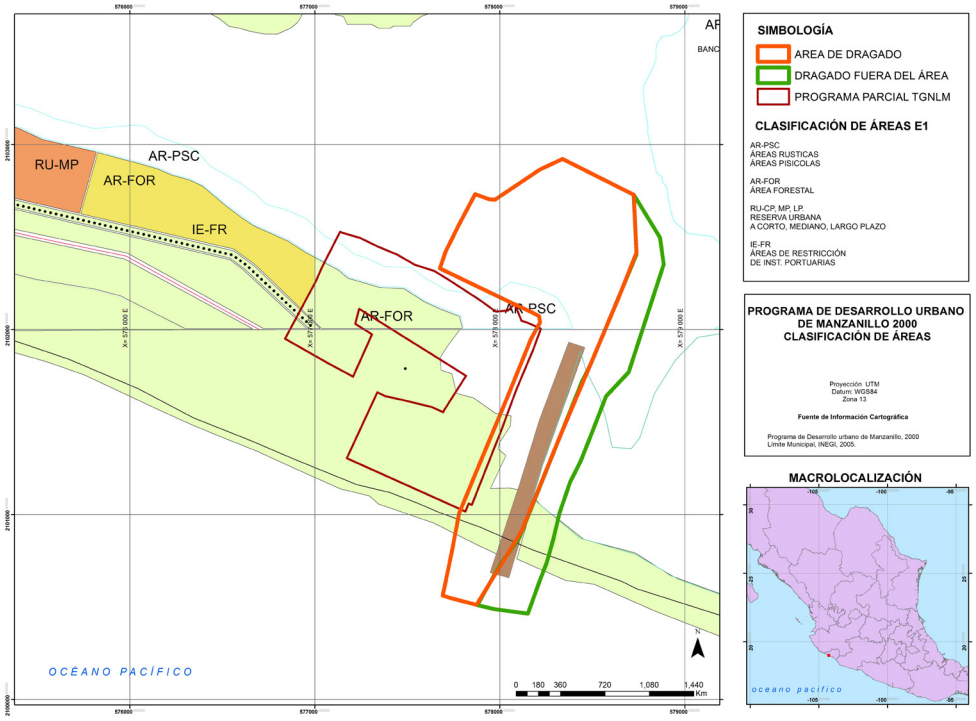
50. In addressing the issue of land use in the area in question, on 12 July 2008 the State of Colima issued a "partial program" (almost six months after the AIA-LNG was issued) which determined the applicable uses for the LNG Terminal as "high impact-heavy industry."[88] According to an expert consulted by the Secretariat,[89] this is equivalent to redefining the LNG Terminal land use for this project.

Figure 7: City boundaries of Manzanillo and location of the LNG Terminal



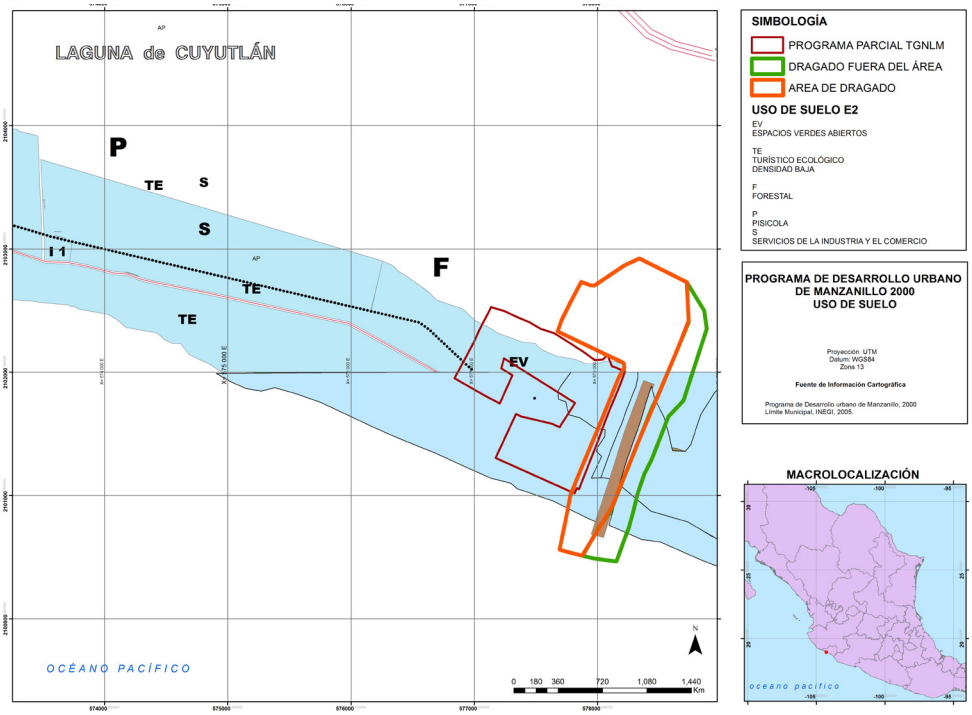
Source: PDUM 2000, Area classification map

Figure 8: Classification of LNG Terminal areas, per PDUM 2000



Source: Image derived from: PDUM 2000, *Estrategia de usos del suelo y zonificación*, February-July 2000, and the regional form of the environmental impact statement for the LNG Terminal project, ch. II, p. 5 (see complete bibliographical reference in note 36 of the factual record).

Figure 9: Land uses applicable to the LNG Terminal, per PDUM 2000



Source: Image derived from: PDUM 2000, *Estrategia de usos del suelo y zonificación*, February-July 2000, and the regional form of the environmental impact statement for the LNG Terminal project, ch. II, p. 5 (see complete bibliographical reference in note 36 of the factual record).

4.5 State and regional ecological zoning plans

51. In addition to the City of Manzanillo Urban Development Plan, this factual record also considers the state and regional plans.

52. The following paragraphs analyze the relationship of both port terminal projects to the instruments derived from the ecological zoning in force at the time when the projects' environmental viability was assessed:

- The Colima State Ecological Zoning Plan (*Programa de Ordenamiento Ecológico del Territorio del Estado de Colima*—POETEC 1993), and
- the Regional Ecological Zoning Plan for the Cuyutlán Lagoon Subwatershed (*Programa de Ordenamiento Ecológico Regional para la Subcuenca de la Laguna de Cuyutlán*), published in 2003 and modified in 2007 (PROETSLC 2003 and PROETSLC 2007, respectively)

4.5.1 Analysis of the projects in light of POETEC 1993

53. The POETEC 1993, published on 28 August 1993 in the Official Gazette of the State of Colima, is a mandatory environmental policy instrument determining land uses and the management of natural resources. It establishes the regionalization of the state of Colima in accordance with its geographical and ecological characteristics, and must be given consideration for the execution of works, services, projects, or activities in the state.[90]

54. The POETEC 1993 was in force at the time of filing of the EIS-LPG (24 February 2004) and the EIS-LNG (8 November 2006) and was not amended during the environmental impact assessment procedure for both projects or before their respective approvals were issued (June 2004 and February 2008, respectively).[91] More recently, the POETEC was amended twice, the first time on 11 August 2012 and then on 21 September 2013 (both amendments may be viewed in the Official Gazette of the State of Colima).

55. The Colima state ecological zoning plan specifies that the agencies of the federal, state, and municipal public administration are obligated to comply therewith in connection with the planning and execution of works, services and activities, as well as for the granting of approvals, permits, licenses, and concessions.[92] Thus, the environmental impact assessment procedure for the LPG Terminal and LNG Terminal projects must, for purposes of approval, consider the ecological zoning of the area.

56. The POETEC 1993 contemplates four levels at which environmental management units are determined: 1) climatic-geographical area; 2) ecological province; 3) terrestrial system, and 4) terrestrial landscape. The projects are situated on the Cuyutlán coastal plain and are classified as belonging to the Armería terrestrial landscape.[93] The POETEC 1993 establishes four ecological zoning policies for Colima: protection, restoration, conservation, and use. The environmental management units and zoning policies must be considered in connection with the implementation of projects such as these facilities.

57. The zoning policies contemplated in the POETEC 1993 for the areas and zones of influence of the sites where the projects were developed are *protection*, *use, and conservation*.[94] The POETEC 1993 states that the *protection* policy applies "where, given the exceptional or unique characteristics of the natural resources in the environmental management unit, preservation and extreme stewardship thereof are indispensable. In such cases, compatible economic activities may only be carried out with severe restrictions."[95] As regards the *restoration* policy applicable to the LNG Terminal project, the POETEC 1993 establishes that "where the alteration of ecological equilibrium observed in an environmental [management] unit is so severe as to necessitate measures favouring optimal conditions … compatible economic activities with moderate restrictions shall be permitted."[96] In accordance with the POETEC 1993, the zoning policy *use* in the area of both projects allows agriculture and livestock, which may only be engaged under restricted conditions.

IN BRIEF

The POETEC 1993 defines the following zoning policies:

LNG Terminal	LPG Terminal
Protection, use, and conservation	Protection, use, and conservation

58. When evaluating the LPG Terminal, DGIRA considered that the POETEC was too general as its scale of analysis was "too extensive" and while it categorized the area as "protected", it did not specify compatible activities.[97] The AIA-LPG establishes that the project "does not contradict land use policies"[98] and determined that the authorization was granted "without prejudice from State and Municipal authority on environmental matters".[99]

59. With respect to the LNG Terminal, the DGIRA office considered that the project did not oppose protection and conservation policies under POETEC[100] since "opening of the Tepalcates Canal will generate optimal conditions for the environmental quality of the lagoon".[101] The Secretariat notes that the hydrodynamic studies justifying the improved environmental quality were made available to DGIRA over four years after the authorization was issued (see paragraphs 97-100 of the factual record).

4.5.2 Introduction to the Cuyutlan Lagoon Regional Plan in force in July 2003 (PROETSLC 2003)

60. The PROETSLC 2003 was published on 5 July 2003 in the Official Gazette of the State of Colima.[102] According to the enabling order:

> The agencies and entities of the federal, state, and municipal governments are obligated to adhere to the provisions of this program for the planning and execution of works, services, and measures as well as for the granting of approvals, permits, licenses, and concessions that, according to their authority, shall grant in the area comprised in this program.[103]

61. The PROETSLC 2003 was in force at the time of filing of the EIS-LPG (24 February 2004) and the EIS-LNG (8 November 2006) with the DGIRA, and remained in force when the LPG Terminal project was approved on 23 June 2004. The PROETSLC 2007 was published on 3 May 2007, whereas the LNG Terminal project was approved on 11 February 2008. In this case, the DGIRA took into consideration the updated version of the plan. The PROETSLC 2003 defines various environmental policies and, of these, the following are applicable to the project areas:

Table 3: PROETSLC 2003 environmental policies applicable to the projects[104]

Use policy
Use is permitted, provided that soil fertility is maintained, erosion is prevented, water is used rationally, soil, water, and air pollution and degradation levels are reduced, and the vegetation cover is conserved and increased.
Conservation policy
Contemplated for areas where current land use consists of relatively unaltered systems that have been used rationally and with representative ecological and economic values. This policy strengthens and, as necessary, reorients economic activities so as to make more efficient use of natural resources and protect the environment. A basic criterion of this policy is that the existing land use is not to be changed.
Protection policy
This policy applies to land included in protected natural areas and land exhibiting geoecological characteristics, floral and faunal endemism, and high biological and geographical diversity. By virtue of the environmental functions and services they provide, these areas require rational, controlled, and planned use to prevent their degradation. This policy ensures the sustainable use of natural resources in order to maintain the ecological function of systems that provide for aquifer recharge, afford habitat for plant and animal species, and/or prevent erosion and desertification.

62. As may be seen in Figure 10, the PROETSLC 2003 establishes the following land uses for the UGAs corresponding to the projects:

    a. **Agriculture (Agr).** Applies to areas where agriculture has historically been practiced and that are still suited to this purpose. Adequate measures must be taken to prevent soil and water degradation, organize agriculture to allow for the introduction of technical improvements aimed at significantly increasing production and productivity, and improve the living conditions for communities engaged in agricultural work.
    b. **Terrestrial natural spaces (ENT).** Refers to spaces warranting the establishment of natural areas and the reinforcement of existing natural areas. It is considered important to protect and conserve areas harboring plant and animal species of conservation interest.

IN BRIEF

"Coastal lagoons such as Cuyutlán are among the most ecologically important wetlandst, rich in flora and fauna."

PROETSLC 2003

63. The following paragraphs present the manner in which each project is related to the ecological zoning plan set out in the PROETSLC 2003.

i) Relationship of the LPG Terminal project to the PROETSLC 2003

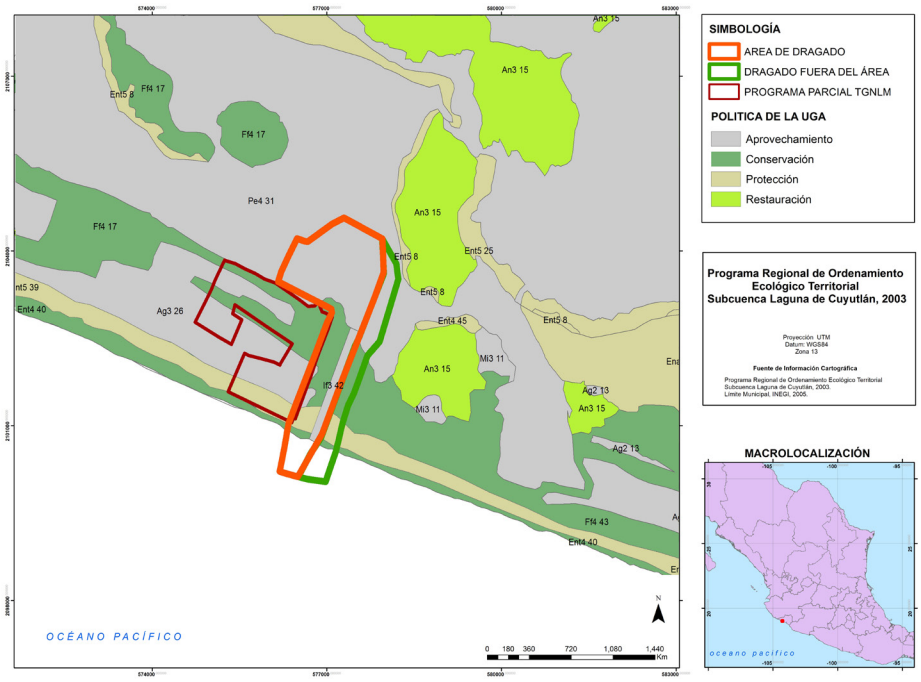
64. The CEC Secretariat found no analysis in the EIS LPG on the project compatibility with PROETSLC 2003. Upon review of both documents, compatibility of the project described in the EIS LPG and the UGAs in the PROETSLC 2003 is not evident. The paragraphs below describe the types of parcels which surround the LPG Terminal Project, including the land upon which the Project was constructed. The paragraphs below also delineate the approved uses and limited uses for these parcels as derived from the applicable plans and policies.

Table 4: UGAs and zoning criteria applicable to the LNG Terminal

UGA	Applicable policy	Classification	Designated activities
$Ag_3$26	Use	Agriculture	
$Ff_4$17	Protection	Flora and fauna	
$Ent_4$40	Conservation	Terrestrial natural space	Low-impact tourism
$Ent_5$39	Protection		

65. As shown in Table 4 above, UGA $Ent_5$39 and $Ent_4$40 are classified as terrestrial natural spaces. The policies applicable to these UGAs are protection and conservation with the compatible use being for flora and fauna. For UGA $Ent_5$39, the conditional use is low-impact tourism, while for $Ent_4$40 it is stated only that the recommended type of tourism is low-impact. Figure 10 presents UGAs and environmental policies applicable to the LPG Terminal site.

Figure 10: UGAs and environmental policies applicable to the LPG Terminal



Source: PROETSLC 2003; municipal limits: INEGI, 2005.

66. Information on land use compatibility applicable to each UGA may be consulted on Table 2. The Secretariat also includes a compatibility analysis for each environmental management with respect to the LNG and LPG projects in Appendix 4.

ii) Relationship of the LNG Terminal project to the PROETSLC 2003

67. While the approval of the project was issued after the amended PROETSLC 2007 came into force, the environmental impact statement for the project was filed with the DGIRA while the PROETSLC 2003 was still in force and included incompatible land uses. In accordance with LGEEPA article 35 (see section 4.2), the EIS must establish the relationship with the planning instruments and applicable legal provisions. The UGAs corresponding to the LNG Terminal project at the time of filing of the EIS are shown in Table 5 and in Figure 11.

Table 5: UGAs and zoning criteria applicable to the LNG Terminal

Environmental management units	Applicable policy
If342, $Ac_4$31, and $Ag_3$26	Use
$Ff_4$43 and $Ent_4$40	Conservation
$Ent_5$39 and $Ff_4$17	Protection

68. Among other restrictions in the PROETSLC 2003, Rule 40 provides that "alteration of the coastline, creation of artificial beaches, removal or movement of dunes, or filling and/or cutting in mangrove ecosystems and/or wetlands is prohibited." Further to the amendment of the plan as discussed below, the AIA-LNG provided that the project "anticipates an impact consisting of alteration of the coastline as a result of accretion and erosion."[105] The AIA-LNG stated that, with the widening of the Tepalcates Canal, alteration of the coastline would be apparent to the east of the breakwaters.[106] The reader may wish to consult Appendix 5 on the effects on the Cuyutlán Lagoon hydrology in connection with the widening of the Tepalcates Canal.

IN BRIEF

" Alteration of the coastline, creation of artificial beaches, removal or movement of dunes, and filling and/or cutting in mangrove ecosystems and/or wetlands is prohibited."

PROETSLC 2003

69. In sum, land use classification for the UGAs as defined in the PROETSLC 2003 appeared to be inconsistent with the LNG Terminal project as presented to DGIRA. The reader may consult information on land use compatibility on Table 2. Also, this factual record includes a detailed analysis for each UGA with respect to the LNG and LPG projects in Appendix 4.[107]

4.5.3 Relationship of the projects to the PROETSLC 2007

70. The amendment process for the PROETSLC 2003 took place simultaneously with the DGIRA's review of the EIS-LNG. The PROETSLC 2007 amendment, published 3 May 2007 in the Official Gazette of the State of Colima, establishes policies, guidelines, land uses, and ecological criteria that rendered the LNG Terminal project compatible with the ecological zoning plan.

71. The justification for amending the PROETSLC 2003 invoked the fact that the area was under tremendous development pressure, notably from the Manzanillo Thermal Power Complex, the LPG Terminal and LNG Terminal projects themselves, salt harvesting (predominantly small-scale), and urban growth in Manzanillo. In addition, the construction of a new rail line and a gas pipeline were contemplated, as was the construction of a future container port in basin II of Cuyutlán Lagoon.[108]

72. According to the PROETSLC 2007, the changed development model reflected by this plan is justified by the need to minimize environmental conflicts, internalize environmental costs, and restore and favor the ecological recovery of the subwatershed.[109] The model put forward by the PROETSLC 2007 would ensure the sustainability of the area by implementing new policies in each basin of Cuyutlán Lagoon:[110]

- Basin I: restoration of the upper part of the subwatershed, promotion of a better urban image, and activities favoring local tourism and recreation.
- Basin II: configuration of the basin for a port development, favoring the installation of an energy cluster and an industrial zone on the Campos barrier island;
- Basins III and IV: conservation of both basins, declaring them protected natural areas (PNA).

IN BRIEF

The justification given for amending the PROETSLC 2003 was that the area was under heavy development pressure from the Manzanillo Thermal Power Complex, the LPG Terminal and MLNGT projects, salt harvesting (predominantly on a small scale) and urban growth in Manzanillo.

73. The paragraphs below present the manner in which the LNG Terminal is related to the ecological zoning plan set out in the PROETSLC 2007. The Secretariat includes information on the conformance of the LPG Terminal with the PROETSLC in Table 2.

i. Relationship of the LNG Terminal project to the environmental management units, environmental policies, and designated land uses

74. Figure 11 presents the UGAs and environmental policies applicable to the LNG Terminal project. It may be noted that the main area of the project encompasses UGAs that were redefined for an industrial and services area with an environmental policy of use (UGA 39 A Ei) and designated for the construction of a port in basin II of Cuyutlán Lagoon (UGA 26 A Apc).

75. Particularly applicable to the project is criterion Inf 16, according to which construction work for the canal entrances must avoid increasing coastal erosion. On this note, the EIS-LNG stated that the project was considering the construction of two breakwaters perpendicular to the beach line[111] and that these could engender coastline instability, since depending on wave direction and intensity they might generate sediment deposition and erosion areas adjacent to the structures. The project modifies the hydrodynamic in the Cuyutlan Lagoon as well as nutrient intake. However, the project is supported on the grounds that the Tepalcates Canal will positively affect the regional environmental system (see Appendix 5 of this factual record).[112]

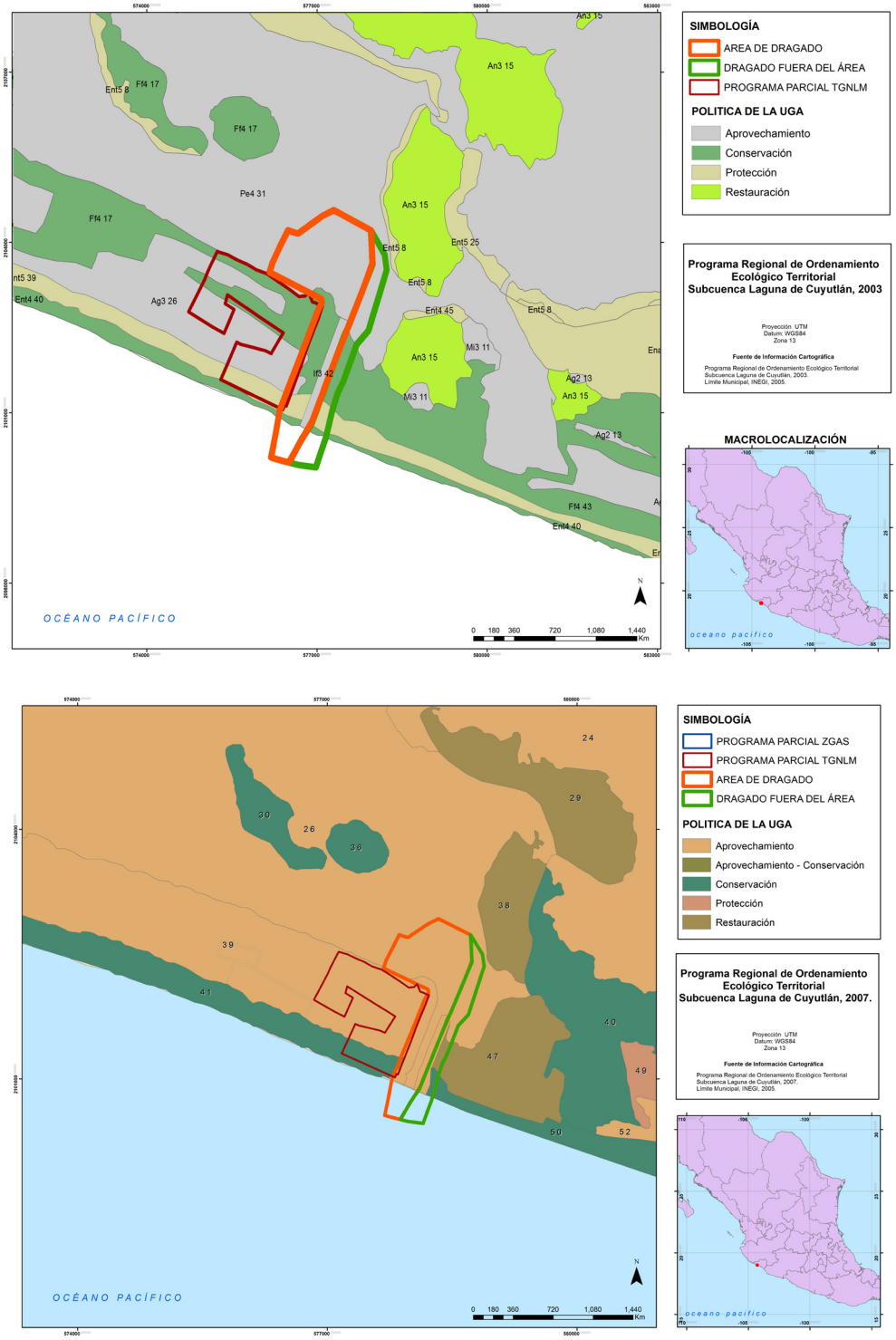
IN BRIEF

The project's conformity with the criteria of the PROETSLC 2007 is premised on the idea that the widening of the Tepalcates Canal would positively alter the regional environmental system.

76. A detailed discussion on the LNG project consistency with the PROETSLC 2007 may be consulted in Table 2. This factual record provides further examination of this in Appendix 4.

77. In summary, both projects do not appear to be consistent with applicable land use when their respective environmental impact assessments were filed. In some cases, the applicable plan (PROETSLC 2003 and PDUM 2000) was adjusted while the EIS was considered by the DGIRA; in others, the DGIRA found that the plan (POETEC 1993) was too general to be considered and did not specify the compatible activities.

Figure 11: UGAs and environmental policies applicable to the LNG Terminal, per PROETSLC 2003 and PROETSLC 2007



Source: PROETSLC 2007; PROETSLC 2003; municipal limits: INEGI, 2005.

5 Actions taken by Mexico to effectively enforce LGEEPA Article 30, LGVS Article 60 *ter*, and NOM-022 in relation to the approval of the environmental impact assessment for the LNG project as regards water flow in the Cuyutlán Lagoon coastal wetland

5.1 Environmental law in question

78. The relevant text of LGEEPA Article 30 (see full text in Appendix 3) provides that in order to obtain an environmental impact approval, interested parties must file an EIS including:

> a description of the possible effects on the ecosystem or ecosystems that may be affected by the work or activity in question, considering the sum total of the elements making up said ecosystems as well as the preventive, mitigation, and other measures necessary to avert and/or minimize the negative effects on the environment.

79. LGVS Article 60 *ter* prohibits any activity involving the cutting of mangroves, as well as any activity affecting the integrity of the mangrove ecosystem, its hydrological integrity, or its productivity. The text of the provision in question is as follows:

> The following are prohibited: removal, filling, transplanting, cutting, or any activity that affects the integrity of water flow in the mangrove area; the ecosystem and its area of influence; its natural productivity; the natural carrying capacity of the ecosystem for tourism projects; any nesting, breeding, refuge, feeding, and spawning grounds; or interactions between the mangrove area, rivers, dunes, the adjacent coastal zone, and corals or that cause changes in ecological characteristics and services.
>
> Works or activities whose purpose is to protect, restore, research, or conserve mangrove areas shall be excepted from the prohibition contained in the preceding paragraph.

80. LGEEPA Article 30 has not been amended since the filing of submission SEM-09-003; the last amendment was published in the DOF on 13 December 1996. In contrast, LGVS Article 60 *ter* was amended by decree published in the DOF on 1 February 2007, after the AIA-LPG was issued (23 June 2004); therefore, it is not applicable to the approval of the LPG project but is applicable to the approval of the LNG Terminal project (11 February 2008). As regards NOM-022, published in the DOF on 10 April 2003, it was amended on 7 May 2004 with the addition of specification 4.43, establishing exceptions to the prohibitions in the standard through the concept of environmental offsetting.[113] The standard, as amended, is applicable to both gas terminals.

81. LGVS Article 60 *ter* recognizes "the 'hydrological, biological, chemical, ecological, economic, cultural, and social' value of the coastal wetlands—construed as the hydrological unit containing mangroves, whose integrity is closely tied to the hydrodynamics of the coastal wetland and associated with the ecosystem of the body of water in which they are found."[114]

82. NOM-022 specifies the scope of LGVS Article 60 *ter* by defining coastal wetlands as "comprehensive hydrological units" containing "mangrove communities."[115] The standard provides that coastal wetlands are:

> transitional coastal ecosystems lying between continental and marine waters, whose vegetation is characterized by being halophytic and hydrophytic, seasonal or permanent, and dependent on the continuous circulation of brackish and salt water. Also included are marine regions up to 6 m in depth in relation to mean lower low water.[116]

83. Thus, undertaking of works or activities must respect the mangrove ecosystem as a plant community and consider the mangrove communities present in the project's area of impact as whole hydrological units. NOM-022 provides that the granting of approvals or licenses for works or activities having any impact on mangroves must guarantee the integrity of their ecosystem.[117] Furthermore, the standard establishes the obligation to assess the impacts on water flow in connection with the approval of non-extractive projects carried out in mangrove ecosystems.

84. NOM-022 prescribes technical criteria for the production of a study generally known as a "hydrodynamic study" (i.e. studies on the motion of the water). The standard provides that the environmental impact assessment must guarantee the integrity of the water flow in the coastal wetland and the balance between water inflows from the continental watershed and from tides.[118] Among other aspects, NOM-022 provides that the EIS must take into consideration:

> the balance between water inflows from the continental watershed and from tides, which determines the mixture of fresh and salt water that creates the estuarine conditions essential to the survival of coastal wetlands and the plant communities they support.[119]

5.2 Submitters' assertions

85. The Submitters assert that Mexico failed to effectively enforce LGVS Article 60 *ter*[120] and NOM-022[121] during the environmental impact assessment for the LNG Terminal project. The Submitters state that the DGIRA twice asked the CFE to provide information on the project's relationship to NOM-022, requiring "technical and scientific evidence"[122] to demonstrate that the LNG Terminal project structures "guarantee the water flow required to maintain or improve the hydrodynamic in the various basins of Cuyutlán Lagoon."[123] The Submitters contend that the DGIRA approved the LNG Terminal project on 11 February 2008 without the requested information"comprehensively demonstrating how the project will impact on water flow towards the four basins of the lagoon due to the opening of the Tepalcates Canal."[124] The Submitters contend that the DGIRA never obtained "the studies necessary to demonstrate that the project guarantees the integrity of the mangrove ecosystem or prevents the fragmentation of the coastal wetland"[125] before approving the project.[126]

86. The Submitters refer to NOM-022 in order to demonstrate the relationship between hydrodynamic and conservation of coastal wetlands, maintaining on this basis that the LNG Terminal project may alter natural flows.[127] According to the Submitters, the LNG Terminal project would result in a widening of the Tepalcates Canal by dredging to a depth of 16 m in both the canal and the lagoon. This, they state, would alter water flow and salinity, thereby affecting the mangrove ecosystem.[128]

87. The Submitters assert, at the time of the submission (February 2009) that construction began on the project in June 2008 without a hydrodynamic study having been performed,[129] and that six months after the issuance of the AIA-LNG, "the most important study needed to determine the impact on Cuyutlán Lagoon" had yet to be obtained.[130] They assert that the clearing of palms, fruit trees, and native species as well as filling in the lagoon system had caused "severe harm to fish, crustacean, and mollusk species and the benthos, considerable impacts on inshore fishing," and "irreversible alteration of water flows from which damage to the entire wetland will ensue."[131]

5.3 Party response

88. In its response, Mexico contends that LGVS Article 60 *ter* "does not establish an absolute prohibition but rather an obligation for the administrative authority to ensure that any work or activity intended to be carried out in mangrove zones does not affect the integrity of the ecosystem," and that the way to determine whether there is such impact is therefore via the environmental impact assessment procedure.[132] Mexico asserts that further to a detailed analysis, the DGIRA concluded in its approval that Alternative 2 (Omega)

for the LNG Terminal project would not affect the functional structure of the mangrove ecosystem and that, on the contrary, it would promote the recovery of the hydrodynamic because it "increases water flow from the ocean towards the Cuyutlán Lagoon…thus favoring circulation towards basins II, III and IV."[133]

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On two occasions, the DGIRA requested a study showing how the condition of the four lagoon basins would improve. The approval was ultimately made conditional on the study.

89. Concerning enforcement of NOM-022 to the LNG Terminal project, the Secretariat consulted documents indicating that DGIRA twice requested studies guaranteeing the hydrodynamic of the site in question.[134] It informs that as part of the conditions placed on the AIA-LNG, a hydrodynamic study was requested in order to prevent, mitigate, or offset the environmental impacts.[135] The studies were eventually filed between March 2010 and February 2012 but it was not until June 2012 that the DGIRA considered this condition to be met (see paragraphs 97-100).

5.4 Enforcement of NOM-022 and LGVS Article 60 ter to the environmental assessment of the LNG Terminal project

90. The EIS-LNG presents information on the integrity of water flow in the mangroves, the ecosystem, and its area of influence;[136] the natural productivity of the mangrove ecosystem; nesting, breeding, refuge, feeding, and spawning grounds,[137] and interactions between the mangroves, rivers, dunes, adjacent coastal zone, and corals[138] or that cause changes in ecological characteristics and services of the mangrove ecosystem.[139] However, the communication between the DGIRA and the developer shows that the authority requested information on:

> The relationship with NOM-022, establishing the manner in which the project adheres to or complies with its provisions.[140]
> …
> Pursuant to REIA Article 36, the technical and scientific evidence, as well as similar experiences, demonstrating that these works guarantee the water flow required to maintain or improve the existing hydrodynamic in the various basins of Cuyutlán Lagoon.[141]

91. On 4 October 2007, in response to the submission of additional information by the developer, the DGIRA again requested:

> Additional information on the exchange of ocean water volumes that will enter the whole system, and the direct consequences thereof for the potential variations in the mean level of the lagoon, and collaterally on the various plant communities (particularly the mangrove communities) and animal communities inhabiting the lagoon, convincingly indicating the manner in which the existing conditions will be improved and specifying how this could occur.[142]

92. The DGIRA asked the CFE on two occasions for a study showing how the opening of the Tepalcates Canal would improve the condition of the four basins,[143] underscoring the need for "technical and scientific evidence" demonstrating that the structures built as part of the project would guarantee the water flow required to maintain or improve the existing water balance,[144] in addition to "information on the interchange of ocean water volumes that will enter the whole system, and the consequences thereof."[145]

IN BRIEF

Before issuing the AIA-LNG, the DGIRA requested technical and scientific information relating to hydrodynamics; however, it did not obtain all the studies it repeatedly requested from the CFE.

93. In response to a request for information from the DGIRA,[146] the CFE contended that any of the LNG Terminal alternatives would generate conditions providing for the sustainability of Cuyutlán Lagoon and would

create favorable conditions for the continuity of the ecological processes essential to the preservation of the biotic community of the mangrove ecosystem and the environmental services which the system provides.[147]

94. On 11 February 2008, the DGIRA approved the LNG Terminal project subject to fulfillment of various terms and conditions, among others the production of a hydrodynamic study "comprehensively demonstrating how the water flow induced by the opening of the Tepalcates Canal would impact on the condition of the four basins."[148]

95. The AIA-LNG states that the developer must evidence the ecological importance and ecosystem services rendered by each basin of the lagoon.[149] The purpose of the hydrodynamic study would be to assess the environmental behavior of the lagoon system and understand the alternatives for the widening of the Tepalcates Canal, as well as other hydraulic infrastructure options that would assist in achieving the goal of sustainable water interchange among the four basins of the lagoon.[150]

96. Condition 3 in AIA-LNG established that the hydrodynamic study should include: a) an environmental assessment comprising the lagoon system current situation: b) a numerical model of the hydrology considering 300 m widening of the Tepalcates Canal; c) a numerical model of the hydrology considering over 300 m widening of the Tepalcates Canal; d) determine whether a wider opening is required at Tepalcates Canal; e) water quality and pisciculture studies, and f) a hydrology study for the Armería river.[151]

97. On 21 April 2008, the CFE submitted technical information concerning compliance with the terms and conditions of the AIA-LNG.[152] On 28 May 2008, the DGIRA notified the CFE that the project "had not adhered" to the condition concerning the hydrodynamic study and therefore found that this condition "is not fulfilled."[153]

98. In addition, a report submitted by the CFE on 11 August 2008 to the Profepa office in the state of Colima states that while the hydrodynamic study had been filed with the DGIRA on 21 April 2008, it did not comply with what had been requested, and that this was why the condition in question was considered unmet. The CFE stated that the hydrodynamic study was still in progress.[154]

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Dredging for the LNG project commenced on 1 February 2010, before completion of the hydrodynamic studies on 26 June 2012.

99. The Secretariat identified information indicating that the CFE notified the DGIRA that dredging would commence "in the water areas" for the LNG Terminal project on 1 February 2010.[155] The following studies and reports for compliance with the condition on the production of a hydrodynamic study were filed with the DGIRA after 1 February 2010.

    i. Global report on hydrodynamic study of Cuyutlán Lagoon (30 April 2010)[156]
    ii. Final report of the hydrological study of the Armería River basin (17 December 2010);[157]
    iii. Report on the analysis of the ecological importance and environmental services offered by each basin making up the Cuyutlán lagoon system (23 January 2012);[158]
    iv. Report on environmental goods and services (17 February 2012);[159]

100. On June 27 2012, DGIRA considered that condition no. 3 listed in the AIA-LNG related to the hydrodynamic information was completed.[160]

101. The following sections presents information that was included in the EIS-LNG regarding the hydrodynamic studies, the characteristics of the water in the lagoon, and the diagnostic study of the Cuyutlán Lagoon mangrove ecosystem. Subsequently, the factual record addresses the findings of the hydrodynamic studies produced by the CFE subsequent to the issuance of the AIA-LNG, with reference to LGVS Article 60 *ter* and NOM-022. This includes an analysis of independent consultants, retained by the Secretariat, from Centro de Investigación y de Estudios Avanzados (Cinvestav),[161] who also analyzed the information on the current condition of Cuyutlán Lagoon and presented their observations. Appendix 5 presents more detailed information

on the general characteristics of coastal lagoons; the hydrological context of Cuyutlán Lagoon and the impact of human activities; the basins of which is composed, and their conservation status as well as water quality.

5.4.1 Diagnostic study of the mangrove ecosystems of Cuyutlán Lagoon in the EIS-LNG

102. In the opinion of the experts consulted by the CEC Secretariat,[162] the first aspect to emphasize is that the EIS-LNG lacks "hard" data and information on the ecological characteristics of the mangrove ecosystem, including: basal area, density, soil characteristics, hydroperiod, productivity, characterization of zones by typology and condition, among others. It is noteworthy that this ecosystem has been defended from the negative impacts of multiple anthropic disturbances, including the opening and widening of the Tepalcates Canal. In any case, the available information only allows for a cursory description of its characteristics and to infer some aspects of its ecology, evolution, patterns, and future requirements.

103. Cuyutlán Lagoon harbours important ecosystems such as tropical deciduous forest, moist deciduous forest, and mangrove and cattail ecosystems, in addition to the extensive coastal strip. Of all these ecosystems, the mangroves are of greatest relevance to the lagoon.[163] Moreover, the vegetation along the bank of the lagoon is largely composed of mangroves: white mangrove (*Laguncularia racemosa*) and red mangrove (*Rhizophora mangle*). These species are listed as "threatened" in NOM-059.[164] The presence of coastal vegetation such as cattail (*Typha domingensis*), saltwort (*Batis maritima*), seashore saltgrass (*Distichlis spicata*), and chamizo or saltbush (*Atriplex* spp.) has been reported. The aquatic vegetation includes *Ruppia maritima, Chara* spp., *Scirpus* spp., *Eleocharis* spp., *Salicornia* spp., grasses (*Poaceae*), and duckweeds (*Lemnaceae*).[165]

104. According to the information submitted by the CFE in the EIS-LNG:

> The mangrove ecosystem occurring in Cuyutlán Lagoon is characterized by being a community dominated by *Laguncularia racemosa*, and although this species can be found growing in isolation, it is also found associated with *Rhizophora mangle*. Both were found growing around the perimeter of basin II, forming a narrow strip 1–50 m wide on the north bank. In the rest of the lagoon, in addition to the two species mentioned, a specimen of the uncommon species *Conocarpus erectus* was also found.[166]

105. The EIS-LNG provides data on the height of the two most abundant species, *Laguncularia racemosa* and *Rhizophora mangle,* which ranges from 3 to 4 metres. The trunk diameter of the first species varies from 5 to 20 cm, whereas it was not possible to determine the diameter of the second mangrove species due to the young age of the trees.[167]

106. The information produced by the CFE in the EIS-LNG establishes that the anthropic disturbances described earlier (see paragraph 102 above) have caused physiological stress to the mangrove community, using the differences in coverage area and plant vigor as indicators thereof.[168] However, according to an expert consulted by the Secretariat, these descriptions do not take account of basic concepts of mangrove physiology, population dynamics, community ecology, and ecological typology.[169] In addition, the EIS-LNG refers to causes and consequences of the mangroves' lack of vigor; for example, adequate water conditions, changes in sediment deposition, microtopography, and land use changes to acquire and use land for urbanization and indiscriminate logging.[170] There is no data for any of the variables mentioned, and it is therefore difficult to state the impacts of any of the disturbances to which the lagoon was subjected before the arrival of the LNG Terminal.[171]

107. In relation to the change of coverage, the EIS-LNG states that:

> the deforestation was not uniform; rather, mangroves were lost in certain areas and gained in others. However, the net impact on the mangroves was negative during the period. The most intense deforestation occurred in basin II because this basin is the closest to the Manzanillo urban and conurban area. It is followed by basin III and lastly by basin IV.[172]

108. The EIS-LNG calculated the loss of mangrove vegetation using the multitemporal analysis method based on satellite images (Landsat) from 1990 and 2003. The results indicate that mangrove deforestation in Cuyutlán Lagoon amounted to 152 ha (24.4% of the original coverage) in 13 years, for an annual rate of 1.87 per cent.[173]

109. While the EIS-LNG states that the Cuyutlán Lagoon ecosystem is in a fragile and vulnerable condition, no data is presented for the relevant characteristics, and there is therefore no reference to a specific spatial context that would allow for follow-up. It is clear that the sum total of activities carried out in the regional and local environmental systems have profoundly disrupted the hydrology of the lagoon (see Appendix 5 with a discussion on historical activities and infrastructure development in the Cuyutlán Lagoon).[174] Therefore, insofar as hydrology is the main variable controlling the ecological processes operating in ecosystems such as coastal lagoons, Cuyutlán Lagoon has been negatively impacted.[175] However, the magnitude, location, and specific causes, apart from land use changes caused by human settlements and industry, are not well characterized prior to the arrival of the LNG Terminal project.[176]

5.4.2 Assessment of the hydrodynamic study developed by CFE

110. The study titled "Informe global de la hidrodinámica de la laguna Cuyutlán" (Global Hydrodynamic Report for Cuyutlán Lagoon),[177] submitted in fulfillment of the condition imposed by the DGIRA for the LNG Terminal project, analyzes the effects of the opening of the Tepalcates Canal on the propagation of the tide wave within the lagoon and water change in the four basins of which the lagoon is composed. The study was conducted with numerical modeling, using the MIKE 21 Flow Model FM coastal simulation tool,[178] combined with field data to validate the results. Some data derived from the study are as follows:

- The entirety of the lagoon in the numerical domain, its topography, and its bathymetry were measured in 2004 and were approximated by photogrammetric plotting in 2008.
- The use of five level measurement points throughout the lagoon system (except in basin IV), along with the installation of a current meter[179] and a pressure sensor. The data from the pressure sensor were fed into the model with boundary conditions.
- The installation of a weather station on the premises of the LPG Terminal project to measure meteorological variables (wind speed and direction, precipitation, etc.) used in the model.
- The model incorporates runoff which was calculated from precipitation, taking account of the physical characteristics and runoff coefficient. Cooling water flows from the Manzanillo Thermal Power Complex, located in basin I, were also included.

111. The MIKE 21 Flow Model FM coastal simulation tool referenced above was calibrated with previously measured values, making it easier to replicate the hydrodynamic behavior of Cuyutlán Lagoon with a margin of error between 5 and 7%. Moreover, the model was validated with velocity measurements taken in the Tepalcates Canal, which reproduced velocity behavior with errors ranging from 10 to 15%.[180] According to the experts consulted by the Secretariat, these are acceptable margins of error. The validation and calibration methodology are considered adequate for the development of hydrodynamic models, since they take into account all variables relevant to the dynamics of a coastal lagoon.

112. Once the model was validated, simulations were run with the Tepalcates Canal closed or widened to 250, 300, or 350 m. The results for the canal widened to 250 m show that its opening and widening promote water circulation and interchange in Cuyutlán Lagoon, which would result in improved water quality and, consequently, in the improved environmental quality of the site. The simulation with the canal widened beyond 250 m did not significantly change the effect on the hydrodynamic.[181]

113. The numerical modeling shows that basin IV exhibits evidence of water accumulation (0.67 m) and a flow rate of approximately 2 m^3/s when the Tepalcates Canal is open.[182] The figure below shows this region of the lagoon in January 2004, when the canal was closed (Figure 12). According to an expert consulted by the

Secretariat, the figure shows that flooding is more extensive in 2014 as a result of the opening of the canal, but water flow is not smooth.[183] To achieve this, it would be necessary to open culverts between basins III and IV and allow not only water accumulation but also water interchange. Another way to allow water to flow would be to put a bridge (or culvert) to the Palo Verde salt marsh, which would benefit fishermen and ecotourism service providers and would avert the salinization of arable land.[184]

Figure 12: Section of basin IV after widening of Tepalcates Canal

The photo taken in January 2014 shows a larger flooded area in the salinas zone of basin IV after the opening of the Tepalcates Canal.

5.5 Final considerations on the hydrodynamic of Cuyutlán Lagoon

114. The following information was included in a report prepared by an expert consulted by the Secretariat.

115. The water quality in the Cuyutlán Lagoon has changed over time. While the indicators used in the reports analyzed were not those best suited to a solid diagnostic study of the water quality in Cuyutlán Lagoon, they did yield a water quality index based on trophic status.[185] The results indicate that the trophic status (the classification of a water body based on the productivity of the system) of the lagoon has improved over time due to the opening of the Tepalcates Canal, mainly in basins II and III. The condition of basin I depends on the Ventanas Canal, whereas basin IV is relatively uninfluenced by the Tepalcates Canal but could be more influenced by the Palo Verde salt marsh. Despite the paucity of water quality data, the available information indicates an influx of domestic and industrial wastewater, which is a factor contributing to the degradation of the lagoon.[186]

116. The hydrodynamic in Cuyutlán Lagoon has been altered over time by changes in the lagoon's hydrological connectivity with the land and the ocean. The opening of the Tepalcates Canal has improved the overall hydrodynamic of the lagoon, primarily that of basins II and III. However, it is very probable that the biological diversity and trophic ecology of the lagoon have been altered in both basins. The lack of long-term systematic ecological monitoring makes it difficult to make any observations about this factor.[187]

117. The population derives one or more ecosystem services from Cuyutlán Lagoon, and this influences the perception of its value, depending on the standpoint from which it is viewed. The fishermen, although noticing a general decline in production, state that the opening of the Tepalcates Canal benefited them. The salt harvesters recognize that while seawater entry is important, it must be limited for better control of the evaporation ponds. All things considered, the experts consulted by the Secretariat (Jorge Herrera and Ismael Mariño) did not identify any solid technical arguments to support the idea that the best action to conserve the biodiversity and environmental quality of the lagoon is "no action."[188] The environmental characteristics that maintain or increase the landscape value of the lagoon, as well as affording refuge to birds and other aquatic and terrestrial species, are gradually and substantially diminishing.[189]

118. In sum, despite some improvements to these wetlands in Manzanillo, the mangrove ecosystem has suffered serious impacts and its area has been reduced by hydrological disturbances deriving from alterations of both the regional and the local environmental systems. PROETSLC 2007 recognizes that the Cuyutlán lagoon requires changing the development model based upon resolution and minimization of environmental conflicts, internalization of environmental costs and restoration of the watershed.[190] Experts consulted by the Secretariat recognize the current environmental benefits of the Tepalcates Canal on the hydrodynamics of the lagoon. The historical use and systematic deterioration of the Cuyutlán lagoon justified a strategy—outlined in the PROETSLC 2007—that fosters conservation and restoration of the ecological and cultural heritage of this coastal ecosystem. The inclusion of Cuyutlán lagoon basins III and IV on the list of Ramsar sites is, without a doubt, a major step in that direction. Most of the infrastructure, industrial activities and modifications to the Cuyutlán lagoon historically have occurred at reservoirs I and II.

119. PROETSLC 2007 includes—in addition to land use restrictions—the following restoration and conservation actions that should consider efforts to preserve and protect the Cuyutlán lagoon:[191]

- Financing for actions that strengthen the lagoon system's environmental services;
- Actions that ensure conservation of basins III and IV to strengthen the lagoon's hydrodynamics and its physicochemical and biological conditions, with particular emphasis on the conservation of critical habitats (mangroves and beaches);
- The PROETSLC 2007 proposes the creation of a federal and/or state protected natural area including the upper part of the sub-basin and reservoir IV. It also calls for the conservation and ecological integrity of reservoir IV and the Palo Verde estuary;

- Restoration of UGAs with ecological protection and conservation guidelines in order to strengthen environmental services;
- Decrease fishing activities in the Cuyutlán lagoon during the season al ban and the use of regulated fishing nets. The PROETSLC 2007 proposes to search for alternatives to the economic activities associated with the environment.

120. In the absence of widening the Tepalcates Canal, the Cuyutlán Lagoon would become a salt marsh of little biological or ecological value, dominated by halophilic and marsh vegetation, with poor chances of providing ecosystem services to local residents.[192]

6 Continuing commitment to transparency

121. Factual records provide detailed information regarding asserted failures to effectively enforce environmental law in Canada, Mexico or the United States that may assist submitters, the NAAEC Parties, and other interested members of the public in following up on the matters addressed. This factual record draws no conclusions regarding Mexico's alleged failures to effectively enforce its environmental law, as asserted by the Submitters, nor does it draw conclusions regarding the effectiveness of the Party's enforcement efforts.

122. In accordance with Council Resolution 14-06, this factual record presents factual information concerning the Submitters' assertions in regard to: i) the relationship between the LPG and LNG Terminal projects and the ecological zoning of the territory, and ii) the environmental impact assessment for the LNG Terminal project with respect to the Cuyutlán lagoon water flow (hydrodynamics).

123. In its 2014 Ministerial Statement, the Council implemented a new reporting approach to increase the transparency of the SEM process by having a NAAEC Party provide "an update on actions taken" in connection with submissions concluded in the past year (including those on which a factual record has been prepared):[193]

> Twenty years ago, North American leaders made a commitment that trade and economic growth would go hand-in-hand with effective trilateral cooperation and protection of the environment across the continent.
> […]
> This year, we implemented a new reporting approach for submissions on enforcement matters (SEM) as part of our continued commitment to transparency and to the SEM modernization process. Following a proposal by the Joint Public Advisory Committee, each country provided an update on actions taken in connection with submissions concluded in the past year.

124. In order to facilitate this update process, this factual record provides relevant information on the matters raised in the submission.

125. In accordance with NAAEC Article 15(3), this factual record is "without prejudice to any further steps that may be taken" in regard to submission SEM-09-002 (*Wetlands in Manzanillo*).

Notes

Except as otherwise indicated, all official documents cited herein are in the Secretariat's archives. Page references to the submission and the response in this factual record correspond to the original Spanish versions of these documents.

1 North American Agreement on Environmental Cooperation, published in the Official Gazette of the Federation (*Diario Oficial de la Federación*—DOF) on 21 December 1993.

2 Full details regarding the various stages of the process as well as previous Secretariat determinations and factual records can be found on the CEC's Submissions on Enforcement Matters page at <http://www.cec.org/submissions>.

3 SEM-09-002 (*Wetlands in Manzanillo*), Article 14(1) Submission (4 February 2009) <http://goo.gl/EvCCm> (viewed 28 July 2015) [Original Submission].

4 SEM-09-002 (*Wetlands in Manzanillo*), Article 14(1) Determination (9 October 2009), <http://goo.gl/U0u3d> (viewed 28 July 2015) [Article 14(1) Determination].

5 SEM-09-002 (*Wetlands in Manzanillo*), Revised Article 14(1) Submission (2 November 2009), <http://goo.gl/ne5to> (viewed 28 July 2015) [Revised Submission].

6 SEM-09-002 (*Wetlands in Manzanillo*), Article 15(1) Notification (4 April 2007), online at <http://goo.gl/mhxdYY> (viewed 28 July 2015).

7 *Ibid,* §252.

8 SEM-09-002 (*Wetlands in Manzanillo*), Council Resolution 14-06 (8 July 2014), online at <http://goo.gl/AptfZt> (viewed 28 July 2015) [Council Resolution].

9 Reasons for Council Instructions regarding Submission SEM-09-002 (*Wetlands in Manzanillo*) (8 July 2014), online at <http://goo.gl/VKcv2k> (viewed 29 July 2015).

10 CEC Secretariat, file no. A14/SEM/09-002/142/REQ (15 August 2014).

11 CEC Secretariat, file no. A14/SEM/09-002/148/REQ (15 August 2014).

12 CEC Secretariat, file no. A14/SEM/09-002/150/REQ (15 August 2014).

13 CEC Secretariat, file no. A14/SEM/09-002/145/COM (15 August 2014).

14 CEC Secretariat, file no. A14/SEM/09-002/152/COM (15 August 2014).

15 CEC Secretariat, file no. A14/SEM/09-002/157/DEV (17 October 2014)

16 CEC Secretariat, file no. A14/SEM/09-002/163/DEV (21 October 2014)

17 "I am instructed by Mr. Luis Carlos Cao Romero to tell you that the information required by your representative can be obtained from the Mexican environmental authorities … Semarnat and Profepa": electronic mail from the Energy Branch (*Subdirección de Energéticos*), Western Energy Regional Division (*Subgerencia Regional de Energéticos Occidente*), Federal Electricity Commission (*Comisión Federal de Electricidad*—CFE) (30 October 2014). "[T]he information you request … must be requested from the CFE, since it is the developer for the purposes of the Mexican environmental authorities and would certainly have the complete information on the LNG Terminal that you require": electronic mail from the Environmental Division of the company KMS de GNL (26 November 2014).

18 CEC Secretariat, file no. A14/SEM-09-002/161/REC (21 October 2014).

19 Quetzalli Ramos Campos is a lawyer for the Center for Research and Economic Teachings (CIDE) and is currently a consultant at the Committee on the Environment of the Senate of the Republic. She has been a consultant for various organizations and was senior attorney in the environmental department of the firm Jáuregui, Navarrete y Nader; She has collaborated with several civil society organizations such as the Center for Civic Collaboration (CCC), the Heinrich Boll Mexico Foundation, among others. She is a columnist for the Environmental Law and Ecology Journal.

20 Eric Mellink is an agricultural engineer specializing in in Animal Science graduated from the National School of Agriculture from the Autonomous University of Chapingo, in Chapingo, Mexico; He earned his doctorate in Arid Lands Resource Sciences and Wildlife Ecology at the University of Arizona. From 1989 to date he is a researcher at the Center for Scientific Research and Higher Education of Ensenada (CICESE) in Ensenada, Baja California. In addition to being the author of five books, Dr. Mellink has published 116 articles in journals of formal arbitration (69 of them on birds, 57 on aquatic birds, coastal birds or marine birds); 46 chapters in books; 31 scientific contributions not peer-reviewed and presented 133 contributions to scientific conferences. He has directed six doctoral theses, 23 masters degrees in science and ten bachelor's degrees. Dr. Mellink is a member of the National System of Researchers since 1985; since 1998 he is a national researcher level 2. He has been awarded the 2010 Environmental Merit Award granted by the Secretary of the Environment and Natural Resources and with the Award for Scientific Conservation in Conservation Biology in 2012. Program VW Por Amor al Planeta.

21 See Rogelio Zizumbo-Villarreal's resume at note 77 *infra.*

22 See Jorge Herrera and Ismael Mariño-Tapia's resumes at note 161 *infra.*

23 Arturo Keer is a graduate of the career in Physics of the National Autonomous University of Mexico, he has obtained a Master of Science in Combustion and Pollution Control, and a PhD specializing in simulation of burners by Computational Fluid Dynamics at the University of Sheffield, England. He has worked for the University of Sheffield, developing mathematical models for simulating high temperature processes. He was a professor of postgraduate studies at the Research Center for Advanced Materials, SC, Chihuahua, Mexico, where he was also in charge of Fuel Cell Laboratory and later became Chief of the Division of Environment. He has participated as an assistant to environmental auditor at various PEMEX facilities, and has been a consultant in environmental matters since 2005, participating in the development of national emissions inventories in Mexico, and carrying out various projects on environmental issues.

24 Luisa Manzanares is a Chemical Engineer from the Universidad Veracruzana; she has a Masters and PhD in Combustion and Control of Pollution from the University of Sheffield, England; also she has obtained a Diploma in Advanced Quality Management and has attended courses and workshops on emission inventory, air quality monitoring, atmospheric modeling, indicators of sustainable development, market research, risk analysis, environmental impact, environmental audits, among others. She has been honored with the appointment of Level 1 in the National System of Researchers, she has more than 20 published articles, has participated as a speaker at various events, both nationally and internationally, and under her supervision has titled five doctors, five teachers in science and 8 undergraduate students. At present she is a Senior Consultant on Energy and Climate Change and the Coordinator of the Mexico GHG Program CESPEDES (Commission for Private Sector Studies for Sustainable Development) affiliated to the Business Coordinating Council (*Consejo Coordinador Empresarial*). On February 11, 2016 she was appointed Social Advisor for the Coordination of Evaluation of the National Climate Change Policy at the National Institute of Ecology and Climate Change.

25 NAAEC, Article 15(5): "The Secretariat shall submit a draft factual record to the Council. Any Party may provide comments on the accuracy of the draft within 45 days thereafter."

26 NAAEC, Article 15(6): "The Secretariat shall incorporate, as appropriate, any such comments in the final factual record and submit it to the Council."

27 Paragraph 19.7 of the *Guidelines for Submissions on Enforcement Matters under Articles 14 and 15 of the North American Agreement on Environmental Cooperation,* in force as of 11 July 2012 [Guidelines], provides:

The Secretariat, to the extent possible, should conclude revising the draft factual record and provide Council with the final factual record, including a version that makes apparent any changes made, normally within 45 working days of receiving Party comments.

28 NAAEC, Article 15(7): "The Council may, by a two-thirds vote, make the final factual record publicly available, normally within 60 days following its submission."

29 Council Resolution, note 8 *supra*.

30 Mexican Environmental Protection Act (*Ley General del Equilibrio Ecológico y la Protección al Ambiente*), published in the DOF on 28 January 1988 [LGEEPA].

31 LGEEPA Environmental Impact Regulation (*Reglamento de la LGEEPA en materia de Evaluación del Impacto Ambiental*—REIA), published in the DOF on 30 May 2000 [REIA].

32 General Wildlife Act (*Ley General de Vida Silvestre*), published in the DOF on 3 July 2000 [LGVS].

33 F.A. Silva Bátiz, S. Hernández Vázquez, A.J. Nené Preciado, and A.D. Vázquez Lule, "Caracterización del sitio de manglar Laguna de Cuyutlán," in Conabio (2009), *Sitios de manglar con relevancia biológica y con necesidades de rehabilitación ecológica* (Mexico City) [Silva *et al*. 2009], at 12, online at <http://goo.gl/HIu2ef> (viewed 29 July 2015); J. Torres and A.L. Quintanilla-Montoya (2014), "Alteraciones antrópicas: historia de la Laguna de Cuyutlán, Colima," *Investigación ambiental: Ciencia y política pública* (Mexico: Semarnat-INECC), vol. 6, no. 1 [Torres and Quintanilla-Montoya 2014], at 30–1, online at <http://goo.gl/oub1Qv> (viewed 29 July 2015).

34 E. Mellink and M. Riojas López (2008), "Waterbirds (other than Laridae) nesting in the middle section of Laguna Cuyutlán, Colima, Mexico," *International Journal of Tropical Biology and Conservation* (Universidad de Costa Rica), vol. 56, no. 1 [Mellink and Riojas López 2008], at 392, online at <http://goo.gl/4y2WMT> (viewed 19 October 2015); Torres and Quintanilla-Montoya (2014), note 33 *supra,* at 30.

35 E. Mellink and M. Riojas López (2007), "Modificaciones estructurales artificiales de Laguna Cuyutlán, Colima, México," *Revista Geográfica,* no. 142 [Mellink and Riojas López 2007], at 133, online at <http://goo.gl/nvgk4K> (viewed 29 July 2015).

36 Regional form of the environmental impact statement for the LNG Terminal project, filed by the CFE with the Environmental Impact and Risk Branch (*Dirección General de Impacto y Riesgo Ambiental*—DGIRA) on 11 November 2006 [EIS-LNG], ch. VII, at 82.

37 The Cuyutlán Lagoon is situated approximately 460 km south of Marismas Nacionales. Distance calculated using Google Maps, <https://maps.google.ca> (viewed 7 August 2015).

38 Mellink and Riojas López 2007, note 35 *supra,* at 132.

39 See the Ramsar Convention website at <http://goo.gl/Xr28wf> (viewed 19 October 2015).

40 EIS-LPG, note 43 *infra,* at 1-3.

41 *Ibid*., at 2.

42 AIA-LPG, note 43 *infra,* at 1.

43 Regional form of the environmental impact statement for the LPG Terminal project, filed by Zeta Gas del Pacífico, S.A. de C.V. with the DGIRA on 24 February 2004 [EIS-LPG], at 3–5, 9; environmental impact and risk approval for the *Planta de Suministro de Gas L.P. en el municipio de Manzanillo, Colima* project, in file no. S.G.P.A./DGIRA/DEI.-1443.04 (23 June 2004), issued by the DGIRA to Zeta Gas del Pacífico, S.A. de C.V. [AIA-LPG], at 9.

44 EIS-LPG, note 43 *supra,* at 9.

45 *Ibid*., at 3.

46 IFAI, "Estudio para el recurso de revisión 1528 en contra de la Secretaría de Comunicaciones y Transportes" available at <http://goo.gl/5juKzl> (undated) and Wikia, "Vida y obras del Lic. Jesús Silverio Cavazos. Colima Suministra de gas LP a la zona occidente del país <http://goo.gl/NvqxSp> (12 May 2006).

47 EIS-LNG, note 36 *supra,* ch. II, at 1.

48 *Ibid.*

49 *Ibid.*

50 *Ibid.,* ch. II, at 8.

51 Environmental impact and risk approval for the *Manzanillo Liquid Natural Gas Terminal* project (LNG Terminal), in file no. S.G.P.A./DGIRA.DG.0464.08 (11 February 2008), issued by the DGIRA to the CFE [AIA-LNG], at 126.

52 *Ibid.,* at 27.

53 Diario de Colima, "En Manzanillo la obra más importante del sexenio: FCH" (28 de marzo de 2012), available at: < http://goo.gl/oiFOAx> (consulted on 25 January 2016).

54 Revised Submission, note 5 *supra,* at 7–10.

55 EIS-LPG, note 43 *supra,* at 188.

56 Revised Submission, note 5 *supra,* at 8.

57 *Ibid.,* at 7. The PROETSLC order was published in the Official Gazette of the State of Colima (*El Estado de Colima, Periódico Oficial del Gobierno Constitucional*) on 5 July 2003, vol. 88, no. 29, supplement 1.

58 Revised Submission, note 5 *supra,* at 7–8.

59 *Ibid.,* at 8, and AIA-LPG, note 43 *supra,* at 11.

60 *Ibid.,* at 4.

61 Cfr. Regulation to the LGEEPA respecting Environmental Land Use Planning (*Reglamento de la LGEEPA en materia de Ordenamiento Ecológico*), Article 3, Section XXVII.

62 Revised Submission, note 5 *supra,* at 11.

63 *Ibid.,* at 11.

64 *Ibid.,* at 6.

65 REIA Article 11.

66 LGEEPA Article 3 paragraph XXI.

67 LGEEPA Article 28.

68 See SEM-09-002 (*Wetlands in Manzanillo*), Article 14(3) Response (14 October 2010), online at <http://goo.gl/8EEK4> [Response], at 45–7.

69 *Ibid.,* at 45.

70 *Ibid.,* at 46.

71 *Ibid.,* at 39.

72 *Ibid.,* at 38–9

73 *Ibid.,* at 51–2.

74 *Ibid.,* at 52.

75 *Ibid.*

76 *Ibid.*

77 Rogelio Zizumbo Villarreal is a PhD on Planning and Sustainable Development by the *Universidad Autónoma de Baja California*; he has other postgraduate studies on sustainable development and environment from *El Colegio de México A.C.*, known as "LEAD Program". Dr. Zizumbo-Villarreal is a researcher and full-time professor at the Faculty of Sciences from University of Colima, where he teaches Environmental Sciences and Risk Management. Dr. Zizumbo-Villarreal also teaches the specializaton on Environmental Sciences, Management and Sustainability. Dr. Zizumbo-Villarreal is currently researching on environmental management, planning, territorial development, managemnent of natural resources and environmental impact and risk assessment. Dr. Zizumbo-Villarreal is also director and partner of Proyectos Digitales, S. de R. L., a private company.

78 Government of the Free and Sovereign State of Colima, "Síntesis del Plan Director de Desarrollo Urbano del Estado de Colima," published in the Official Gazette of the State of Colima, vol. 85, no. 46, at 1306, 4 November 2000, <http://goo.gl/E5xh4> (viewed 29 July 2015).

79 *Idem*.

80 The Decision amending the PDUM was published in the Official Gazette on 12 June 2004: Government of the Free and Sovereign State of Colima: "Acuerdo de modificación al Programa de Desarrollo Urbano de Manzanillo, en lo concerniente a la clasificación de áreas de las siguientes parcelas del ejido Campos, 61 Z-1 P 3/4, 62 Z-1 P ¾, 72 Z-1 P ¾, 76 Z-1 P ¾, 77 Z-1 P ¾, 80 Z-1 P ¾, 81 Z-1 P ¾. 83 Z-1 P ¾, 89 Z-1 P ¾ y 90 Z-1 P ¾, de área forestal (AR-FOR) a reserva urbana a mediano plazo (RU-MP), así como su zonificación que pasa de turístico ecológico (TE) a industria pesada de alto impacto y riesgo (13)," published in the Official Gazette of the State of Colima, vol. 89, no. 30, at 3, 12 June 2004.

81 AIA-GLP, *supra* note 43, at 13.

82 Decision on the Partial Urbanization Plan titled "Terminal de Almacenamiento mediante Planta de Suministro de Gas L.P." (Storage Terminal in the form of a LPG Supply Plant), Official Gazette of the State of Colima, 30 October 2004, at 1104.

83 EIS-LNG, note 36 *supra,* ch. III, at 44.

84 AIA-LNG, note 51 *supra,* at 39.

85 PDUM 2000, Land Use and Zoning Strategy, February-July 2000, inset showing the polygon containing the limits of the Manzanillo population center.

86 AIA-LNG, note 51 *supra,* at 9.

87 *Ibid*., at 39–40.

88 State of Colima, Executive decree, *Periódico Oficial el Estado de Colima* (12 July 2008).

89 See Rogelio Zizumbo's biographical note at note 77 *supra*.

90 *Ibid*., fourth recital clause.

91 The AIA-LPG was issued on 23 June 2004, the AIA-LNG on 11 February 2008; in both cases, the DGIRA issued the environmental impact approval..

92 POETEC 1993, articles 2–4.

93 AIA-LPG, note 43 *supra,* at 15; AIA-LNG, note 51 *supra,* at 31.

94 POETEC 1993, at 12.

95 *Ibid*., Article 5 paragraph I.

96 *Ibid*., Article 5 paragraph II.

97 AIA-GLP, note 43 *supra*, at 11.

98 AIA-GLP, note 43 *supra*, p. 13.

99 *Idem*.

100 AIA-TGNLM, nota 51 *supra*, pp. 31.

101 AIA-TGNLM, nota 51 *supra*, pp. 118.

102 The PROETSLC 2003 was published on the basis of Articles 17 paragraph VIII, 34 paragraph II, and 38 paragraph V of the Colima State Environment Act for Sustainable Development (*Ley Ambiental para el Desarrollo Sustentable*) and Article 63 of the Colima State Human Settlements Act (*Ley de Asentamientos Humanos*).

103 PROETSLC 2003, Article 3.

104 PROETSLC 2003, at 5.

105 *Ibid.,* at 81.

106 *Ibid.,* 81–2.

107 Appendix 4 was developed using information from a report prepared by Rogelio Zizumbo Villarreal, a consultant to the CEC Secretariat (see note 77 *infra*).

108 Government of the Free and Sovereign State of Colima, "Decreto por el que se reforma el Programa Regional de Ordenamiento Ecológico Territorial de la Subcuenca Laguna de Cuyutlán" (Order amending the Regional Ecological Zoning Plan for the Cuyutlán Lagoon Subwatershed), published 3 May 2007 in the Official Gazette of the State of Colima, vol. 92, no. 29 [PROETSLC 2007], at 3, online at <http://goo.gl/86wFBS> (viewed 20 August 2015).

109 *Ibid.*

110 *Ibid.,* recital and Article 5.

111 EIS-LNG, note 36 *supra,* at VI–10.

112 Jorge Herrera and Ismael Mariño Tapia, *Diagnóstico de los estudios de hidrodinámica elaborados por la Comisión Federal de Electricidad en relación con el proyecto Terminal de Gas Natural Licuado Manzanillo, Colima* (April 2015).

113 NOM-022-Semarnat-2003 [NOM-022] and Decision adding specification 4.43 to Mexican Official Standard NOM-022-Semarnat-2003, Establishing the specifications for the preservation, conservation, sustainable use, and restoration of coastal wetlands in mangrove zones, published in the DOF on 7 May 2004.

114 See: "Vida silvestre. El artículo 60 *ter* de la ley general relativa y la Norma Oficial Mexicana NOM-022-Semarnat-2003, Que establece las especificaciones para la preservación, conservación, aprovechamiento sustentable y restauración de los humedales costeros en zonas de manglar, no vulneran el derecho a la irretroactividad de la ley," *Semanario Judicial de la Federación y su Gaceta*, vol. I, tenth judicial epoch, March 2014, at 563, 1a. LXXVI/2014 (10a.), tesis aislada, online at <https://goo.gl/80Mfos> (viewed 8 October 2015).

115 NOM-022, note 113 *supra,* section 1.2.

116 *Ibid.,* section 3.36.

117 *Ibid.,* section 4.0.

118 *Ibid.,* sections 4.0, 4.12, and 4.42.

119 *Ibid.,* section 4.12.

120 LGVS Article 60 *ter* (see paragraph 80 of the factual record) was added on 1 February 2007 and, for that reason, its relationship to the LNG Terminal project was not considered at the time the EIS was filed with the DGIRA.

121 Revised Submission, note 5 *supra,* at 9–12.

122 *Ibid.,* at 9–10.

123 *Ibid.,* at 10.

124 *Ibid.,* at 11.

125 *Ibid.,* at 9.

126 *Ibid.,* at 11.

127 *Ibid.,* at 10–11.

128 *Ibid.,* at 14–15.

129 *Ibid.,* at 14.

130 *Ibid.*

131 *Ibid.*

132 Response, note 68 *supra,* at 66. In support of this statement, the Party cites the judgment in amparo action (*juicio de amparo*) 438/2007-II before the Third District Judge of the State of Quintana Roo.

133 *Ibid.,* at 67.

134 Semarnat-DGIRA, file no. S.G.P.A/DGIRA/DG/0175/07 (23 January 2007) [First request for LNG Terminal information], at 5; Semarnat-DGIRA, file no. S.G.P.A/DGIRA/2343/07 (4 October 2007) [Second request for LNG Terminal information], at 7–8.

135 Response, note 68 *supra.*, at 64–5.

136 AIA-LNG, note 51 *supra,* at 94; EIS-LNG, note 36 *supra,* ch. III, at 46–7, 79; Federal Electricity Commission, file no. 7B/2007/JMRA-00533 (9 October 2007) [Second delivery of additional LNG Terminal information], ch. III, at 3.

137 AIA-LNG, note 51 *supra,* at 95–6; EIS-LNG, note 36 *supra,* ch. III, at 47.

138 AIA-LNG, note 51 *supra,* at 97–9; EIS-LNG, note 36 *supra,* ch. III, at 47.

139 AIA-LNG, note 51 *supra,* at 100; EIS-LNG, note 36 *supra,* ch. III, at 47.

140 First request for LNG Terminal information, note 134 *supra,* at 3.

141 *Ibid.,* at 5.

142 Second request for LNG Terminal information, note 134 *supra,* at 7.

143 *Ibid.*

144 First request for LNG Terminal information, note 134 *supra,* at 5.

145 Second request for LNG Terminal information, note 134 *supra,* at 7.

146 *Ibid.*

147 Second delivery of additional LNG Terminal information, note 136 *supra,* ch. III, at 151.

148 AIA-LNG, note 51 *supra,* at 140.

149 *Ibid.*

150 *Ibid.*

151 *Ibid*, at pp. 140-143.

152 CFE, Financed Investment Projects Division (*Direction de Proyectos de Inversión Financiada*), Projects and Construction Sub-Division (*Subdirección de Proyectos y Construcción*), Thermal Power Projects Office (*Coordinación de Proyectos Termoeléctricos*), file no. 7B/2008/JMRA-00166 (21 April 2008).

153 DGIRA, file no. SGPA/DGIRA/DESEI/0591/08 (28 May 2008), at 3.

154 CFE, file no. ROMZ-341/08, "Reporte semestral" (Half-year report) (6 August 2008), at 13.

155 Ports and Merchant Marine Office (*Coordinación General de Puertos y Marina Mercante*), Ministry of Comunications and Transportation, file no. 7.3.360.10 (27 January 2010).

156 CFE, file no. 7B/2010/JMRA 000208 (30 April 2010).

157 CFE, file no. 7B/RAFV/2010-000746 (17 December 2010).

158 CFE, file no. 7B/2012/RAFV-000043 (23 January 2012).

159 CFE, file no. 7B/RAFV/2011-000528 (25 July 2011).

160 DGIRA, file no. S.G.P.A./D.G.I.R.A/D.G./4900 (27 June 2012).

161 Jorge Herrera obtained a doctorate from the Universidad de Barcelona, Spain, in 1993. He is currently a level 3C senior scientist in the Ocean Resources Department of the Centro de Investigación y de Estudios Avanzados (Cinvestav), Mérida unit, and a level 3 member of the National System of Researchers of the National Council of Science and Technology (*Consejo Nacional de Ciencia y Tecnología*—Conacyt). Dr. Herrera is in charge of the primary production and phytoplankton labs. Among his main lines of research are: development of indicators of the health of Yucatán Peninsula coastal ecosystems; study of variables and factors related to the composition, distribution, and frequency of toxic algal blooms in the Caribbean and the Gulf of Mexico; vulnerability of mangroves to climate change, with study of their adaptation to climate change and mitigation of its effects upon them; blue carbon in coastal ecosystems; mangrove restoration programs; long-term climate change resilience and ecological stability of tropical coastal ecosystems; development of indicators of the condition of coastal ecosystems and their application to monitoring programs; assessment of the ecosystem services provided by tropical coastal environments. Dr. Herrera has published 71 articles in peer-reviewed journals (available on the ISI web platform). He has supervised five doctoral candidates, 26 master's students, and 20 undergraduates. In addition, he has participated in over 39 coastal services and oceanographic projects for industry and in 34 scientific research projects (being the lead researcher on 28 of these). On 2 February 2010, World Wetlands Day, the Government of Mexico, acting by Semarnat, recognized Dr. Herrera "for his important contribution to research on the coastal wetlands of Mexico." In addition, on 29 April 2010, the organization Pronatura (Yucatán Peninsula) recognized him for "his contribution and leadership in the conservation of our natural heritage."

Ismael Mariño Tapia obtained a doctorate from the University of Plymouth (England) in 2003. He did postdoctoral work at the same institution on video image processing for coastal observation and support for coastal management decision-making. Since May 2005 he has been a level 3B senior scientist at Cinvestav, Mérida unit, and is a level 2 member of Conacyt's National System of Researchers. Dr. Mariño is in charge of the coastal processes and physical oceanography lab. His research interests include coastal morphodynamics, hydrodynamics of coral reef and coastal lagoons, dynamics of submarine groundwater discharge, and coastal oceanography in general. He has published 29 articles in peer-reviewed journals (available on the ISI web platform) and has supervised two doctoral candidates, six master's students, and six undergraduates. In addition, he has participated in nine oceanographic services projects for industry and in eleven scientific research projects (being the lead researcher on three of these).

162 Jorge Herrera and Ismael Mariño Tapia, note 112 *supra.*

163 Federal Electricity Commission, Civil Engineering and Earth Sciences Office (*Gerencia de Estudios de Ingeniería Civil y Ciencias de la Tierra*—CFE-GEIC) (2010), *Informe final del estudio hidrológico de la cuenca del río Armería: Factibilidad de conexión entre el río Armería y el vaso IV de la laguna Cuyutlán* [CFE-GEIC Hydrological Study 2010], ch. IV, at 203, 222, 237.

164 Mexican Official Standard NOM-059-Semarnat-2010, *Environmental protection–Mexican native species of wild flora and fauna–Risk categories and specifications for their inclusion, exclusion, or change–List of species at risk*, published in the DOF on 6 March 2002; Mellink and Riojas López 2007, note 35 *supra,* at 135.

165 Mellink and Riojas López 2007, note 35 *supra,* at 135.

166 EIS-LNG, note 36 *supra,* ch. IV, at 161.

167 *Ibid*, at 161, 330.

168 *Ibid,* at 161, 330-328.

169 Jorge Herrera and Ismael Mariño Tapia, note 112 *supra.*

170 EIS-LNG, note 36 *supra,* ch. IV, at 161.

171 *Idem*.

172 *Ibid.,* ch. IV, at 330.

173 *Ibid.,* ch. IV, at 328, 330.

174 See Mellink and Riojas López 2007, note 35 *supra*.

175 EIS-LNG, note 30 *supra,* ch. IV, at 330.

176 See Mellink and Riojas López 2007, note 35 *supra*, at 139.

177 Federal Electricity Commission, Civil Engineering and Earth Sciences Office (2012), *Informe final de hidrodinámica en el interior del sistema lagunar de Cuyutlán* [CFE-GEIC Final Water Balance Report], at 63; Federal Electricity Commission, Civil Engineering and Earth Sciences Office, Mexico, D.F. (2010), *Estudios para dar respuesta a las condicionantes emitidas por la DGIRA en el resolutivo de impacto ambiental para el proyecto de la Terminal de Gas Natural Licuado en Manzanillo, Colima* [CFE-GEIC Study on Conditions 2010].

178 For a description of the model, see "MIKE 21, 2D modeling of coast and sea," online at <http://goo.gl/J5wW7L> (viewed 13 August 2015).

179 A current meter is an instrument that measures the current velocity in bodies of water such as oceans, rivers, streams, and estuaries.

180 CFE-GEIC Study on Conditions 2010, note 177 *supra,* at 31–5.

181 *Ibid.,* at 56–62.

182 *Ibid.,* at 60.

183 Jorge Herrera and Ismael Mariño Tapia, note 112 *supra*, at 21.

184 *Idem*.

185 *Ibid*, at 31.

186 *Idem.*

187 *Idem.*

188 CEC Secretariat interviews with Rogelio Zizumbo and Eric Mellink (3 December 2014); Esperanza Salazar Zenil (2 December 2014), and opinions of Jorge Herrera and Ismael Mariño (April 2015).

189 Interviews with Jorge Herrera, Ismael Mariño (April 2015), and Eric Mellink (3 December 2014).

190 PROETSLC 2007, p. 3.

191 PROETSLC 2007 and Jorge Herrera and Ismael Mariño Tapia, note 112 *supra*, at 33.

192 Assuming only the existing projects inside the Cuyutlan Lagoon and without additional port infrastructure development.

193 CEC Council, CEC Ministerial Statement – 2014, Twenty-first Regular Session of the CEC Council, Yellowknife, Northwest Territories, Canada (17 July 2014), available at <http://goo.gl/u5TqsN> (retrieved 29 July 2015).

Appendices

LNG terminal.

Appendix 1a
Council Resolution: 14-06

Distribution: General
C/C.01/14/RES/06/Final
ORIGINAL: English

8 July 2014

COUNCIL RESOLUTION: 14-06

Instruction to the Secretariat of the Commission for Environmental Cooperation regarding submission SEM-09-002 (*Wetlands in Manzanillo*) in connection with the assertions that Mexico is failing to effectively enforce Article 4 of the Political Constitution of the United Mexican States (*Constitución Política de los Estados Unidos Mexicanos*); Articles 1, 2, 3, and 4 of the Convention on Wetlands of International Importance Especially as Waterfowl Habitats; Articles 20 *bis* 2, 30, 35, and 35 *bis* of the General Ecological Balance and Environmental Protection Act (*Ley General del Equilibrio Ecológico y la Protección al Ambiente*—LGEEPA); Article 60 *ter* of the General Wildlife Act (*Ley General de Vida Silvestre*—LGVS); Article 32 *bis* of the Federal Public Administration Act (*Ley Orgánica de la Administración Pública Federal*—LOAPF); Article 60 of the Federal Administrative Procedure Act (*Ley Federal de Procedimiento Administrativo*—LFPA); Articles 2, 4 paragraph IV, 13 paragraph III, 22, and 46 of the Regulation to the LGEEPA Respecting Environmental Impact Assessment (*Reglamento de la LGEEPA en Materia de Evaluación del Impacto Ambiental*—REIA); Articles 6, 7 paragraph I, 8, 10, 13, 14, 36, 48, 49, and 50 of the Regulation to the LGEEPA Respecting Environmental Land Use Planning (*Reglamento de la LGEEPA en Materia de Ordenamiento Ecológico*—ROE); Articles 1 paragraph VII, and 40 of the Environment Act for Sustainable Development of the State of Colima (*Ley Ambiental para el Desarrollo Sustentable del Estado de Colima*—LADSEC); Articles 48 and 66 of the Human Settlements Act of the State of Colima *(Ley de Asentamientos Humanos del Estado de Colima*— LAHEC); NOM-022-SEMARNAT-2003, *Establishing the specifications for the preservation, conservation, sustainable use, and restoration of coastal wetlands in mangrove areas* ("NOM- 022"); and NOM-059-SEMARNAT-2001, *Environmental protection - Native species of Mexican wild flora and fauna - Risk classes and specifications for their inclusion, exclusion, or change - List of species at risk*

THE COUNCIL:

SUPPORTIVE of the process provided for in Articles 14 and 15 of the North American Agreement on Environmental Cooperation (NAAEC) regarding Submissions on Enforcement Matters and the preparation of factual records;

ACKNOWLEDGING the important role of the Secretariat, as the administrator of the Submissions on Enforcement Matters (SEM) process, in facilitating information-sharing among members of the public and their governments on matters concerning the effective enforcement of environmental law;

AFFIRMING that one of the objectives of the NAAEC, as indicated in Article 1, is the promotion of transparency;

CONSIDERING the revised submission, filed on 2 November 2009, by Bios Iguana, A.C., represented by Gabriel Martínez Campos and Esperanza Salazar Zenil (the "Submitters"), and the response provided by the Government of Mexico on 14 October 2010;

HAVING REVIEWED the 19 August 2013 Notification by the Secretariat recommending the development of a factual record with respect to certain assertions made by the Submitters;

REAFFIRMING the definition of "environmental law" provided in Article 45(2)(a) of the NAAEC and referenced in Guideline 5.1 of the *Guidelines for Submissions on Enforcement Matters under Articles 14 and 15 of the North American Agreement on Environmental Cooperation* (the "Guidelines");

EMPHASIZING that pursuant to Article 14(1) of the NAAEC and Guideline 5.1, the preparation of a factual record is to be based on assertions made by the Submitter(s); and

TAKING INTO ACCOUNT Guideline 10.4, which provides for the Council to offer its reason(s) for factual record instructions in writing to be placed in the SEM Registry;

HEREBY UNANIMOUSLY DECIDES:

TO INSTRUCT the Secretariat to prepare a factual record in accordance with Article 15(4) of the NAAEC and the Guidelines, regarding the following assertions that Mexico is failing to effectively enforce its environmental law:

a) LGEEPA Article 35 and REIA Article 13 paragraph III, with respect to the alleged failure to establish the relationship between the Manzanillo LPG Project and the environmental land-use plan;

b) LGEEPA Article 35 and REIA Article 13 paragraph III, with respect to the alleged failure to establish the relationship between the Manzanillo LNG Project and the environmental land-use plan; and

c) LGEEPA Article 30, LGVS Article 60 *ter* and NOM-022, with respect to the environmental impact assessment for the Manzanillo LNG Project, and with specific reference to the hydrodynamic flow in the coastal wetland of the Cuyutlán Lagoon;

TO DIRECT THE SECRETARIAT:

a) to post the Council's reasoning for its vote in the SEM Registry, as provided in Guideline 10.4;

b) to conclude the preparation of the draft factual record as provided in Guideline 19.5 and submit it to the Council in accordance with Article 15(5) of the NAAEC; and

c) to provide the Council with its overall work plan for gathering the relevant facts, to keep the Council informed of any future changes or adjustments to such plan, and to promptly contact the Council in connection with any clarification required with respect to the scope of the factual record hereby authorized.

APPROVED BY THE COUNCIL:

Dan McDougall
Government of Canada

Enrique Lendo Fuentes
Government of the United Mexican States

Jane Nishida
Government of the United States of America

Appendix 1b

Reasons for Council Instructions regarding Submission SEM-09-002 (*Wetlands in Manzanillo*)

Pursuant to its commitment to transparency and in its capacity as the governing body of the Commission for Environmental Cooperation (CEC) responsible for overseeing the implementation of the North American Agreement on Environmental Cooperation (NAAEC), the Council of the Commission for Environmental Cooperation (the "Council"), hereby makes public its reasons for the instructions to the Secretariat for the preparation of a factual record regarding submission SEM- 09-002 (*Wetlands in Manzanillo*).

1. The Secretariat's Article 15(1) Notification

In its Article 15(1) Notification, issued on 19 August 2013, the Secretariat recommended to the Council that the development of a factual record was warranted in connection with the assertions of a failure to effectively enforce:

(i) Human Settlements Act of the State of Colima (*Ley de Asentamientos Humanos del Estado de Colima*—LAHEC) Article 48 paragraph I, with respect to the amendment of the Manzanillo Urban Development Plan (*Programa de Desarrollo Urbano de Manzanillo*) (§103-125);

(ii) General Ecological Balance and Environmental Protection Act (*Ley General del Equilibrio Ecológico y la Protección al Ambiente*—LGEEPA) Article 20 *bis* 2 and Regulation to the LGEEPA Respecting Environmental Land Use Planning (*Reglamento de la LGEEPA en Materia de Ordenamiento Ecológico*—ROE) Articles 7, 8 and 10, with respect to the implementation of the Coordination Agreement for the Drafting, Issuance and Execution of the Regional Ecological Zoning Program for Laguna Cuyutlán (the "Coordination Agreement") (§149-171);

(iii) LGEEPA Article 35 and Regulation to the LGEEPA Respecting Environmental Impact Assessment (*Reglamento de la LGEEPA en Materia de Evaluación del Impacto Ambiental*—REIA) Article 13 paragraph III, with respect to the alleged failure to establish the relationship between the Manzanillo LPG Project and the environmental land-use plan (§182-197);

(iv) LGEEPA Article 35 and REIA Article 13 paragraph III, with respect to the alleged failure to establish the relationship between the Manzanillo LNG Project and the environmental land-use plan (§202-220); and

(v) LGEEPA Article 30, General Wildlife Act (*Ley General de Vida Silvestre*—LGVS) Article 60 *ter* and NOM-022-SEMARNAT-2003 *Establishing the specifications for the preservation, conservation, sustainable use, and restoration of coastal wetlands in mangrove areas*), with respect to the environmental impact assessment for the Manzanillo LNG Project, and with specific reference to the hydrodynamic flow in the coastal wetland of the Cuyutlán Lagoon and REIA Article 47, concerning compliance with the conditions of the environmental impact authorization for the LNG project (§225-251).

2. The Council's Instruction to the Secretariat

In Council Resolution 14-06, the Council instructs the Secretariat to prepare a factual record in connection with the alleged failure to enforce the following:

a) LGEEPA Article 35 and REIA Article 13 paragraph III, with respect to the alleged failure to establish the relationship between the Manzanillo LPG Project and the environmental land-use plan;

b) LGEEPA Article 35 and REIA Article 13 paragraph III, with respect to the alleged failure to establish the relationship between the Manzanillo LNG Project and the environmental land-use plan; and

c) LGEEPA Article 30, LGVS Article 60 *ter,* and NOM-022, with respect to the environmental impact assessment for the Manzanillo LNG Project, and with specific reference to the hydrodynamic flow in the coastal wetland of the Cuyutlán Lagoon.

Reasons of Canada and Mexico

1. Explanation Regarding the Definition of "Environmental Law" under the NAAEC

A) Regarding Article 48 paragraph I of the LAHEC

Article 48 paragraph I of the LAHEC does not meet the test of Article 45(2) of the NAAEC on the meaning of "*environmental law,*" given that said provision does not have as its *primary purpose* the protection of the environment nor the prevention of a danger to human life or health, but instead establishes the coherence of urban development programs with other planning instruments such as the environmental land-use plan.

Article 48 paragraph I of the LAHEC reads as follows:

> **Article 48.** Municipal urban development plans shall contain the following, in addition to the basic elements to which Article 43 of this Act refers:
>
> I. The consistency of the Municipal Urban Development Plan with the National, State, and Municipal Development Plans, the State Urban Development Plan, and the Environmental Land Use Plan;…

A simple mention of an instrument of environmental planning in a statute does not mean that the principal purpose of the provision falls within the meaning of Article 45(2) of the NAAEC and thus can be analyzed under the Submissions on Enforcement Matters Process ("SEM Process").

In its Response, the Party advised that the *principle of sustainable development* in Article 25 of the Federal Constitution requires that all national policies include environmental protection objectives. However, the inclusion of these objectives in the development and execution of national policies does not mean that every one of them would fall under the scope of the SEM Process or fulfill the requirements of Article 45(2) of the NAAEC.

B) Regarding the Coordination Agreement

In its Article 14(1)(2) Determination of 13 August 2010 (§35), the Secretariat acknowledged that the Coordination Agreement does not constitute environmental law" as defined in Article 45(2) of the NAAEC.

As advised by Mexico in its Party Response, the Coordination Agreement does not meet the test of Article 45(2) of the NAAEC on the meaning of "environmental law," given that said Agreement does not constitute a statute or a regulation whose primary purpose is the protection of the environment, or the prevention of a danger to human life or health; it does not impose generally applicable obligations and it is only binding on the parties thereto. As an administrative instrument that lays out the process for the drafting, issuance and execution of the Regional Ecological Zoning Program for Laguna Cuyutlán, with the objective of determining the actions, timeframes and commitments pertaining to the agenda and calendar of that process, the Coordination Agreement falls outside the scope of the SEM Process.

2. Explanation Regarding the Secretariat's Request for New Information

In its Revised Submission of 2 November 1999, the Submitters alleged that the Government of Mexico issued its environmental impact authorization on condition of a hydrodynamic assessment of the Cuyutlán Lagoon that laid out how the LNG Project would affect the hydrological flow towards the lagoon, and further alleged that the Government of Mexico never received this assessment, which the Submitters consider is essential in order for the Government of Mexico to issue its authorization and to guarantee that the Cuyutlán Lagoon would not be affected by the development of the project. However, neither in their Original Submission nor in the Revised Submission did the Submitters cite Article 47 of the REIA as not being effectively enforced by the Government of Mexico.

Pursuant to Article 14(1) of the NAAEC and Guideline 5.1 of the *Guidelines for Submissions on Enforcement Matters under Articles 14 and 15 of the North American Agreement on Environmental Cooperation*, the identification by submitters of environmental law not being effectively enforced by a Party is a crucial element of the SEM Process, it being beyond the Secretariat's mandate to include in its determinations any environmental law that does not form part of the assertions in a submission.

Reasons of the United States

The United States agrees with Canada and Mexico that the specific issues mentioned in the instructions to the Secretariat in Council Resolution 14-06 should be included in the factual record. However, the United States would also have supported a broader scope for the factual record.

In taking this position, the United States wishes to stress that its views in this case do not reflect a judgment on the part of the United States as to whether Mexico is failing to effectively enforce its environmental law. The position of the United States in this case is based on a long-standing policy in favor of promoting openness and transparency in the SEM Process. This policy is reflected in Executive Order 12915 of May 13, 1994, which requires the United States, to the greatest extent practicable, to vote in favor of a factual record being prepared when recommended by the CEC Secretariat.

Appendix 2
Revised Submission

[Secretariat's translation]

Case: EFFECTIVE ENFORCEMENT OF MEXICAN ENVIRONMENTAL LAW IN LAGUNA DE CUYUTLÁN, COLIMA

COMMISSION FOR ENVIRONMENTAL COOPERATION
393, Rue St. JACQUES OUEST, BUREAU 200
MONTRÉAL (QUÉBEC) CANADA H2Y 1N9

SECRETARIAT OF THE NORTH AMERICAN COMMISSION FOR ENVIRONMENTAL COOPERATION

CITIZEN SUBMISSION

Gabriel Martínez Campos, acting as the legal representative of the civil association BIOS IGUANA, A.C., which has legal status, as is attested to by a certified copy of its document of incorporation (Appendix 1), and Esperanza Salazar Zenil affirm that their legal address to receive and take cognizance of any class of written documents and notifications is calle de Santa Margarita número 227, esquina Angel Urraza, Colonia Insurgentes–San Borja, Delegación Benito Juárez, México, D.F. Furthermore, they authorize María del Carmen Colín Olmos, José Alberto Vázquez Martínez, Alejandro Olivera and Carol Berenice Arriaga García to appear before this Commission, and do affirm:

That by means of this written document and based on Articles 14 and 15 as well as other related and applicable articles of the North American Agreement on Environmental Cooperation (henceforth "NAAEC"), an agreement signed by the United Mexican States, Canada and the United States of America, published in December 1993 and which has been in force since 1 January 1994, we are making a citizen submission:

To denounce the absence of effective enforcement of: the Political Constitution of the United Mexican States, the Ramsar Convention on Wetlands, especially as regards waterfowl habitat, the General Act on Ecological Balance and Environmental Protection Act (*Ley General de Equilibrio Ecológico y Protección al Ambiente*— LGEEPA), the Federal Public Administration Act (*Ley Orgánica de la Administración Pública Federal*), the Federal Administrative Procedure Act (*Ley Federal de Procedimiento Administrativo*), the Federal Wildlife Act (*Ley General de Vida Silvestre*), LGEEPA Environmental Impact Regulations (REIA), LGEEPA Ecological Zoning Regulations, Official Mexican Standard NOM-022-Semarnat-2003, Official Mexican Standard NOM- 059-Semarnat-2001, the Environmental Act for Sustainable Development of the state of Colima (*Ley Ambiental para el Desarrollo Sustentable del Estado de Colima*— LADSEC), the Coordination Agreement for the Preparation, Issuance and Implementation of the Regional Ecological Zoning program for the Laguna de Cuyutlán (*Acuerdo de Coordinación para Apoyar la Formulación, Expedición y Ejecución del Programa Regional de Ordenamiento Ecológico Territorial de la Laguna de Cuyutlán*), the Regional Ecological Zoning Program for the Laguna de Cuyutlán Sub-basin (*Programa Regional de Ordenamiento Ecológico Territorial de la Subcuenca Laguna de Cuyutlán*—PROETSLC), and the Urban Development Program of Manzanillo (*Programa de Desarrollo Urbano de Manzanillo*). This absence of effective enforcement refers to the authorization of two projects, "the Liquefied Petroleum Gas (LPG) Plant in the Municipality of Manzanillo, Colima" and "the Manzanillo Liquefied Natural Gas (LNG) Terminal," which affect the hydrologic cycle, and the flora and fauna found in the Laguna de Cuyutlán area.

Pursuant to Articles 14 and 15 of the North American Agreement on Environmental Cooperation (NAAEC), let us mention the following points:

I. **Grounds for the submission**: The lack of effective enforcement of environmental acts and of specifically enumerated standards in respect of two projects: "the Manzanillo Liquefied Natural Gas (LNG) Terminal" and "the Liquefied Petroleum Gas (LPG) Plant in the Municipality of Manzanillo, Colima," both of which are located in the Laguna de Cuyutlán area, in the state of Colima, Mexico.

II. **Authorities responsible for the lack of effective enforcement of environmental acts and standards:** the Ministry of the Environment and Natural Resources (*Secretaría de* Medio *Ambiente y Recursos Naturales*—Semarnat, formerly Semarnap), the Federal Attorney for Environmental Protection (*Procuraduría Federal de Protección Ambiental*—Profepa), the Attorney General of the Republic (*Procuraduría General de la República*—PGR), the Mexican Geological Service (*Servicio Geológico Mexicano*, formerly *Consejo de Recursos Minerales*), the Federal Electricity Commission (*Comisión Federal de Electricidad*—CFE), the Government of the state of Colima, the Ministry of Urban Development and the Environment of the state of Colima, the Attorney General of the state of Colima, the Manzanillo municipal government, the Armería municipal government, and the University of Colima.

III. **Object of the submission:** The object of this submission is to have the Commission for Environmental Cooperation (henceforth the "CEC") declare its support for the effective enforcement of Mexican environmental legislation in the Laguna de Cuyutlán area (Colima), by all three levels of the Government of Mexico, in compliance with the provisions of NAAEC Articles 5, 6, and 7.

IV. **Facts of the case**: The facts which we shall presently adduce concern the irregularities in the procedures and authorizations that have been carried out in respect of two projects: "the Manzanillo Liquefied Natural Gas (LNG) Terminal" and "the Liquefied Petroleum Gas (LPG) Plant in the Municipality of Manzanillo, Colima."

CHARACTERISTICS OF LAGUNA DE CUYUTLÁN, COLIMA, MEXICO

Laguna de Cuyutlán, which accounts for 90% of the wetlands in the state of Colima, is the fourth-largest coastal wetland in the country and the largest between the National Marshlands (*Marismas Nacionales*) in Nayarit and central Guerrero (Mellink, E. and Riojas-López, M., *Non-breeding waterbirds at Laguna de Cuyutlán and its associated wetlands,* Colima, Mexico*)*.

According to the most recent inventory of the National Commission for the Knowledge and Use of Biodiversity (*Comisión Nacional de Uso y Aprovechamiento de la Biodiversidad*—Conabio), this zone includes 1,330.010 hectares of mangrove (Appendix 2), which represent 23% of the mangroves in Jalisco, Colima and Michoacán, and is considered a priority mangrove conservation area.

Furthermore, Conabio has classified this area as a Priority Marine Area, a Priority Hydrological Area and a Priority Biological Research Area. It should also be mentioned that this is a priority conservation area for migratory birds from North America. In 2008, the lagoon was identified by Conabio as a mangrove site of biological relevance and ecological rehabilitation (http://www.conabio.gob.mx/conocimiento/manglares/doctos/sitios.html). Laguna de Cuyutlán ranks as the twelfth-highest priority wetland area for shorebirds and winter bird counts in the September 2008 Semarnat document titled "Estrategias para la Conservación y Manejo de las Aves Playeras y su Hábitat en Mexico" (Strategies for Conservation and Management of Shorebirds and their Habitat in Mexico).

FLORA. The following are among the species inhabiting this lagoon: *Laguncularia racemosa* (white mangrove), *Rhizophora mangle* (red mangrove) *and Orbignya guacoyule (coquito de aceite),* all of which are specified in NOM-059-Semarnat-2001. In total, 9 families, 127 genera, and 257 species of flora may be found in the lagoon.

FAUNA. The following are among the local or migratory species inhabiting this lagoon: *Ctenosaurus pectinata, C. similis, Iguana iguana, Procyon insularis, Balaenoptera spp., Echrichtius robustus, Nasua nelsoni, Caiman spp., Chelonia agassizi, Lepidochelys olivacea, Dermochelys coriacea, Cocodrylus moreleti, C. acutus, Macrobachium spp., Ancistromesus mexicanus,* Pinctada *mazatlanica, Pinna rugosa, Pternia sterna, Crocibullus escutellatum, Purpura pansa, Noctilio leporinus mexicanos*, *Felis pardalis, Felis wiedii, Felis yagouaroundi, Icterus cucullatus* and *I. walgleri, Nomonyx dominicus, Aramides axillaris, Tachybaptus dominicu, Egretta rufescens, Mycteria americana,*

Chondrohierax uncinatus, Rostrhamus sociabilis, Buteo platypterus, Buteo albonotatus, Micrastur semitorquatus, Larus Herman, Sterna antillarum, Artinga canicularis, Glaucidium palmarum guatemalensis. Of the 327 bird species found in Laguna de Cuyutlán, 56 are aquatic, 104 are land birds, 103 are resident species and 49 are migratory. Two of these species are specified in NOM-059-Semarnat-2001 as threatened and 15 as requiring special protection.

1. FACTS PERTAINING TO ECOLOGICAL ZONING

1.1. On 16 August 2000, Semarnat, the National Ecology Institute (*Instituto Nacional de Ecología*—INE), the Mexican Geological Service (then known as the *Consejo de Recursos Minerales*), the government of the state of Colima, and the municipal governments of Manzanillo and Armería signed the Coordination Agreement for the Preparation, Issuance and Implementation of the Regional Ecological Zoning Program for Laguna de Cuyutlán, located in the state of Colima (henceforth, the Agreement). The Agreement was published on 27 October 2000, in the *Diario Oficial de la Federación* (Official Gazette of the Federation) and came into effect indefinitely (Appendix 2).

1.2. Under Clause No. 5 of said Agreement, the Government of Colima undertook to:

a) "Carry out the actions incumbent upon it pursuant to the execution of the Regional Ecological Zoning Program of Laguna de Cuyutlán,"

c) "Oversee compliance, in the areas under its jurisdiction, with the concessions, permits, licenses, authorizations, environmental feasibility studies, rulings and resolutions granted or made by state public administration with legal land uses and vocations, as well as with the ecological regulatory standards resulting from the regional ecological zoning program of Laguna de Cuyutlán"

d) "Monitor the compatibility of urban development plans and programs, and the instruments that may derive from them, with the provisions arising from the Program..."

1.3. For their part, the Municipalities undertook, under Clause No. 6 of the Agreement, to:

a) "Carry out the actions incumbent upon them pursuant to the execution of the Program..."

b) "Ensure that within their areas of jurisdiction, concessions, permits, licenses, authorizations, rulings and resolutions comply with the ecological precautions and criteria contained in the Program..."

c) "Effect whatever adjustments may be required to ensure that local zoning programs – along with the urban development plans and programs and instruments that may derive from them – are compatible with the provisions arising from the Program..."

1.4. The Government of Colima failed to comply with the obligations contained in the Agreement in that it:

a. Did not execute the regional ecological zoning program of Laguna de Cuyutlán, known as the Regional Ecological Zoning Program of the Laguna de Cuyutlán Sub- basin (*Programa Regional de Ordenamiento Ecológico de la Subcuenca Laguna de Cuyutlán*—PROETSLC), decreed by the Governor of Colima on 5 July 2003, in that it failed to carry out its administrative and oversight obligations, which are stipulated in Clause No. 5 of the Agreement.

This Program establishes conservation and protection policies that are incompatible with "human settlements, infrastructure and equipment" – see PROETSLC regarding Environmental Management Unit (*Unidad de Gestión Ambiental*—UGA) Ent5 39 and UGA Ent4 40 (Appendix 3).

This is demonstrated by the fact that on 12 June 2004 the Government of Colima improperly approved, within the purview of its jurisdiction, the construction and operation of "the Liquefied Petroleum Gas (LPG) Plant in the Municipality of Manzanillo, Colima" by the company Zeta Gas del Pacífico, S.A. de C.V., in the conservation and protection zones of UGA Ent5 39 and Ent4 40 of the Campos Ejido, a project which implies industrial infrastructure and equipment that is expressly prohibited by PROETSLC. In this way, the authorities of the municipality of Manzanillo, with the approval of the Urban Development Branch (*Dirección de Desarrollo Urbano*) of the Government of Colima, modified the Manzanillo Urban Development Program.

Furthermore, this action was a violation of Article 40 of the Environmental Act for Sustainable Development of the state of Colima (Appendix 4).

1.5. The municipal authorities of Manzanillo failed to comply with the Agreement in that:

They modified the Manzanillo Urban Development Program under its jurisdiction. Said modification was published in the *Periódico Oficial del Estado de Colima* (the state of Colima's Official Gazette) on 12 June 2004 (Appendix 5) and entailed changing the land use from forested area to a medium-term urban use reserve, and changing the zoning from ecotourism to high impact, and risk, to heavy industry.

In so doing, it failed to comply with PROETSLC ecological criteria by effecting modifications unfavorable to the area's protection and conservation. In the Agreement (Clause 6, paragraph c), the municipalities undertook to adapt or harmonize their urban development programs with PROETSLC. However, the Municipality violated this provision by adjusting its urban development program to accommodate industrial projects and interests, such as the "the Manzanillo Liquefied Natural Gas (LNG) Terminal" and the "the Liquefied Petroleum Gas (LPG) Plant in the Municipality of Manzanillo, Colima" projects. This also constitutes a violation of Article 40 of LADSEC.

The Coordination Agreement ensues from LGEEPA Article 20 Bis 2:

> ARTICLE 20 BIS 2. The governments of the States and the Federal District, in accordance with the applicable local laws, may draft and issue regional environmental land use plans comprising all or part of the territory of a federated entity.
>
> Where an ecological region is situated within the territory of two or more federal entities, the Federal Government and the governments of the relevant states and municipalities, as well as the Government of the Federal District as applicable, within the scope of their respective jurisdictions, may draft a regional environmental land use plan. For such purpose, the Federation shall enter into the relevant coordination agreements with the local governments involved.

It also ensues from Article 7 of the LGEEPA Ecological Zoning Regulations:

> "Article 7. Environmental land use planning under federal jurisdiction shall be carried out by means of the environmental land use planning process and shall have the following as its outcomes:
>
> 1. Coordination agreements that may be signed with:
>
>   a. The agencies and entities of the Federal Public Administration having jurisdiction to take measures having an impact on the study area, and
>   b. The federal entities, their municipalities, as well as the Federal District and those of its boroughs within the study area.
>
> Article 8. The Ministry shall arrange for the signing of any coordination agreements required under paragraph I of the preceding article or, as applicable, the revision of existing agreements as a basis for any applicable environmental land use planning program, with a view to adapting them to the provisions of this Regulation.
>
> Article 10. The coordination agreements contemplated in this Chapter, its appendices, and the coordination agreements signed within the environmental land use planning process are considered matters of public law and are binding upon the signatories."

Finally, it ensues from REIA Article 2, which provides that "The Federal Executive Branch, acting by the Ministry of the Environment, Natural Resources, and Fisheries is responsible for the enforcement of this regulation in accordance with the applicable legal and regulatory provisions."

Therefore, under the REIA, the Environmental Impact and Risk Branch (*Dirección General de Impacto y Riesgo Ambiental*) was obligated to conform to the legal and regulatory provisions related to land use planning when conducting the assessment of the project, given that pursuant to Article 10 of the LGEEPA Ecological Zoning Regulations, coordination agreements are binding upon the parties. Thus, DGIRA should have ascertained that the Agreement was being performed, especially after being notified that an amendment had been made to the environmental land use plan consisting of insertion of the project that was under assessment.

1.6. On 3 May 2007, the Government of Colima arbitrarily modified PROETSLC (Appendix 6). This modification consisted of changing the conservation, protection and restoration status of certain UGAs into industrial and port status. The UGAs in question correspond to the locations of the "Manzanillo Liquefied Natural Gas Terminal" and the "the Liquefied Petroleum Gas (LPG) Plant in the Municipality of Manzanillo, Colima" projects.

1.7. Under LADSEC Article 1 paragraph VII (Regulating liability for environmental harm and establishing *mechanisms* for ensuring the incorporation of environmental costs into production processes as well as mechanisms for repair of environmental harm), Articles 6, 36, 48, 49, and 50 of the LGEEPA Zoning Regulations are applicable. Therefore, the Government of Colima and the municipalities are authorized to modify PROETSLC to lessen the adverse environmental impacts generated by productive activities, but they may not authorize the increase of such impacts, as occurred with the Laguna de Cuyutlán projects.

1.8. Under LADSEC Article 1 paragraph VII, Articles 7, 13, and 14 of the LGEEPA Zoning Regulations are *applicable*. Pursuant to these articles the Government of Colima and the Municipalities must maintain a public ecological zoning registry. Be that as it may, the competent authorities have not complied with this statutory requirement.

1.9. In addition, LADSEC Article 40 establishes that works or activities carried out in the state shall be subject to the provisions of the pertinent ecological zoning programs, as shall the granting of land use or construction permits, and of zoning certificates. The state and municipal authorities violated this rule when they permitted and/or approved a change in land use to enable the realization of the "the Manzanillo Liquefied Natural Gas (LNG) Terminal" and the "the Liquefied Petroleum Gas (LPG) Plant in the Municipality of Manzanillo, Colima" projects in the Laguna de Cuyutlán area.

1.10. For this reason, on 4 June 2007, a formal criminal complaint was lodged with Attorney General of the state of Colima charging the Governor of the state, the mayors of Manzanillo and Armería and the Minister for Urban Development of the Government of the state of Colima with illegally modifying the Regional Ecological Zoning Program of the Laguna de Cuyutlán Sub-basin (PROETSLC). The Justice Department took no action in response.

1.11. On 24 May 2007, a nullity action was initiated in respect of the decree that modified PROETSLC. This action remains to be adjudicated.

2. FACTS REGARDING SEMARNAT'S ENVIRONMENTAL IMPACT ASSESSMENT

2.1. On 24 February 2004, the company Z Gas del Pacífico S.A. de C.V. submitted its Environmental Impact Statement to Semarnat, the agency responsible for evaluating the project "Liquefied Petroleum Gas (LPG) Plant in the Municipality of Manzanillo, Colima" (Appendix 7).

2.2. The said project consists of the construction and operation of a Liquefied petroleum gas (LPG) and propane gas storage and distribution plant that includes twenty spherical storage tanks, each with a capacity of 43,380 barrels. Sixteen would be for LPG storage and the remaining four for propane. The plant would be located at kilometer 3.5 of the Manzanillo state highway in Colima, on the stretch between Campos and Cuyutlán. Such activities are classified as high risk.

2.3. On this particular issue, we must point out that the Environmental Impact Statement (or MIA, the acronym in Spanish) submitted by the company Z Gas del Pacífico S.A de C.V. lacked a serious and realistic description on the possible effects on the ecosystem which may arise from either the construction of the installation or its future operations. The MIA also failed to consider in a comprehensive manner the elements forming such ecosystems. Nor did it address the preventive and mitigation measures or any other measures necessary to avoid and minimize negative effects on the environment, a requirement stipulated in the first paragraph of Article 30 of the LGEEPA.

2.4. On page 188 of the MIA, the company Z Gas states that "there does not exist any specific regional ecological zoning that includes the project site." This is totally false, whereas the MIA is dated 24 February 2004, PROETSLC dates from 5 July 2003.

2.5. On 23 June 2004, Semarnat issued an environmental impact authorization to Z Gas del Pacífico (Appendix 8), via official communication S.G.P.A./DGIRA.DEI.-1443.04. Said document acknowledged the controversies regarding land use and zoning policies (see pp. 11 and 12 of this authorization). However, it did not consider the fact that this Program was modified after Z Gas del Pacífico submitted its MIA on the project "Liquefied Petroleum Gas (LPG) Plant in the Municipality of Manzanillo, Colima."

2.6. The Manzanillo Urban Development Program (*Programa de Desarrollo Urbano de Manzanillo*—PDUM) dates from 18 September 2000. The PDUM originally classified the area as a forested area and zoned it for ecotourism. The modification to the PDUM, which was made at the late date of 12 June 2004, is arbitrary and illegal. This modification was made nearly four months after Z Gas del Pacífico submitted its MIA to Semarnat.

2.7. In effect, the PDUM was modified in a manner favorable to the interests of Z Gas del Pacífico after the MIA was submitted, without considering the zone's characteristics and the obligation to protect it. It was thus reclassified from a forested area to a medium-term urban reserve area and its zoning changed from ecotourism to high impact, and risk, to heavy industry.

2.8. This, then, was how the provisions of Articles 48 and 66 of the Human Settlements Act of the state of Colima (*Ley de Asentamientos Humanos del Estado de Colima*, Appendix 9) were violated. Under said articles, municipal urban development programs shall be consistent with the state urban development and ecological zoning programs, and the formulation or updating of urban development projects or programs shall ensure a certain mechanism for public participation. This did not occur.

2.9. LADSEC Article 40 was also violated. Under this article, "works or activities carried out in the state shall be subject to the provisions of the corresponding ecological zoning programs, as shall the granting of land use or construction permits and of zoning certificates."

Semarnat was obligated to conform to Article 32 Bis of the Federal Public Administration Act (*Ley Orgánica de la Administración Pública Federal*) establishing that:

"The Minister of the Environment and Natural Resources is responsible for the following matters:…Paragraph V.- In coordination with the federal, state, and municipal authorities, enforcing and promoting compliance with the laws, Mexican official standards, and programs relating to natural resources, environment, water, forests, terrestrial and aquatic wildlife, and fisheries."

LADSEC Article 40 is a Mexican legal provision related to natural resources and the environment. Therefore, Semarnat should not have authorized a project for which the land use permit had been granted in violation of the ecological zoning program, and hence in violation of LADSEC Article 40.

2.10. On 8 November 2006, by means of official letter 7B/2006/JMRA-00688 the Federal Electricity Commission (CFE) submitted a regional Environmental Impact Statement, or MIA, (Appendix 10) to Semarnat's Environmental Impact and Risk Directorate (*Dirección General de Impacto y Riesgo Ambiental*—DGIRA) in respect of its Manzanillo Liquefied Natural Gas Terminal project (TGNLM). Said MIA has been registered under the following code number: 06CL2006G0008.

2.11. This project includes the installation of a terminal for the storage and handling of Liquefied natural gas (methane) at levels exceeding the reporting quantity of 500 kilograms. As such it would be considered a high risky activity, in Laguna de Cuyutlán, which is approximately 8 kilometers south of the city of Manzanillo, Colima.

2.12. The MIA submitted by the CFE did not indicate the harm that the installation and operation of the terminal would cause to each and every one of the species of flora and fauna specified in NOM-059-Semarnat 2001 (Appendix 11), which are categorized as threatened, requiring special protection or in danger of extinction. The species in question are: *Ctenosaurus pectinata, C. similis, Iguana iguana, Procyon insularis, Balaenoptera spp., Echrichtius robustus, Nasua nelsoni, Caiman spp., Chelonia agassizi, Lepidochelys olivacea, Dermochelys coriacea, Cocodrylus moreleti, C. acutus, Macrobachium spp., Ancistromesus mexicanus, Pinctada mazatlanica, Pinna rugosa, Pternia sterna, Crocibullus escutellatum,*

Purpura pansa, Felis pardalis, Felis wiedii, Felis yagouaroundi, Icterus cucullatus and *I. walgleri; Nomonyx dominicus, Aramides axillaris, Tachybaptus dominicu, Egretta rufescens, Mycteria americana, Chondrohierax uncinatus, Rostrhamus sociabilis, Buteo platypterus, Buteo albonotatus, Micrastur semitorquatus, Larus Herman, Sterna antillarum, Artinga canicularis, Glaucidium palmarum, guatemalensis, Laguncularia racemosa* (white mangrove)*, Rhizophora mangle* (red mangrove) and *Orbignya guacoyule (coco de aceite)*.

2.13. Semarnat authorized the project on 11 February 2008, via official letter S.C.G.P.A./DGIRA.0465.08 (Appendix 12). This means that Semarnat failed to comply, by omission, with the obligation stipulated in Article 35 of the LGEEPA. In effect, in assessing the MIA, Semarnat was required to review whether it was in compliance with the LGEEPA, with LGEEPA Regulations and with the applicable Official Mexican Standards, such as NOM-059-Semarnat 2001.

2.14. Under Article 35 of the LGEEPA, Semarnat should have denied the authorization for the following reasons:

a) It contravened the LGEEPA, the LGEEPA Environmental Impact Regulations and Official Mexican Standards NOM-059-Semarnat-2001 and NOM-022-Semarnat-2003, specifically subsections 4.0, 4.1, 4.3, 4.12, 4.23, 4.28, 4.29, 4.37, 4.38 and 4.40; and
b) the works and operations of these projects may result in the declaring of one or more species as threatened or in danger of extinction, particularly when the species specifically listed in NOM-059-Semarnat 2001 are affected (as has already been mentioned, such species do inhabit the Laguna de Cuyutlán area). This issue was brought to the attention of the relevant authorities during the public consultation of 19 May 2006.

2.15. Nor did this MIA cite studies demonstrating that the project guarantees the integrity of the mangrove ecosystem or avoids the fragmentation of coastal wetlands, as stipulated in paragraphs 4.0, 4.1, 4.2, 4.3, 4.12, 4.33 and 4.42 of NOM-022- Semarnat-2003 (Appendix 14).

Further evidence of this is that when requesting additional information (Appendix 15) on 2 February 2007, page 3, DGIRA requested "reference to NOM-022, establishing the manner in which the project adheres to and/or complies with its provisions. On page 5 of that document, the applicant is requested to present, in accordance with REIA Article 36, technical and scientific evidence as well as evidence from similar experiences demonstrating that the project will preserve the water flow levels necessary to maintain or improve the existing water balance in the component water bodies of Laguna de Cuyutlán.

After CFE provided additional information on 4 May 2007, DGIRA made a new request on 4 October 2007, for "complementary information concerning the exchange of seawater volumes that will enter the entire system and the direct impact that this will have on the potential variations in the average level of the lagoon, and concomitantly, on the various plant communities (particularly mangrove communities) and animal communities existing in this habitat, providing convincing evidence of how the existing conditions will be improved and specifying how this could occur" (Appendix 16). Such information should have been submitted in the body of the EIS as an indispensable requisite for assessment of such a large-scale project to be sited in a lagoon system, since the health of a coastal wetland depends upon its water balance, as is clearly set out in the preamble to NOM-022:

0.15 The salinity gradients determine the distribution of plant and animal communities in a hydrological unit, and therefore activities affecting these gradients within and outside the coastal wetland must be regulated;

0.16 The tidal regime determines the dynamics of the estuary and the levels of oxygen reaching the root system. Tidal movements affect the rates of sedimentation and exchange and remove toxic sulfides;

0.18. It is necessary to consider, in the preventive studies and the ecological zoning, the balance of forces between the water budget of the continental watershed and the sum of the forces of the existing oceanic currents and tides, which determine the mixing of fresh and salt water that preserves the estuarine conditions necessary for coastal wetlands and the plant communities they support;

0.20. Coastal wetlands are characterized by having hydrological, contiguity, climate regulation, coastal stabilization, and primary production functions that maintain the marine and land biodiversity dependent upon them;

0.22. Coastal wetlands play a role in recharging the aquifers that contain 97% of the world's non-frozen fresh water, and in Mexico the problem of overexploitation of groundwater is acute;

0.43. The cumulative environmental impacts on the majority of coastal and estuarine ecosystems caused by port and tourism infrastructure development, channelization, dredging, filling, various economic activities taking place in watersheds (farming, ranching, forest clearing, etc.), as well as dumping of urban wastewater, solid waste disposal, and certain forms of energy production, have diminished and degraded productive habitat, increasing sedimentation, affecting estuarine water quality, altering biogeochemical cycles, and putting pressure on the populations of estuarine species in general;

0.44 Such activities may be classified as external or internal. External activities include silting, salinization, eutrophication, watercourse alteration, and contaminated runoff. Internal activities include drying or filling of coastal wetlands, drying caused by channelization and dredging, changes in the watercourse due to fragmentation of the coastal wetland, changes in habitat caused by its conversion for aquaculture and other uses, excessive channelization, and total or partial opening or closing of outlets; deforestation, soil acidification, burning and overgrazing, heavy metal contamination, use of non-selective fishing gear, compaction caused by cattle and human traffic through marshes and other coastal wetlands;

0.48. Infrastructure construction has the potential to alter natural water flows, with changes in nutrient recycling and in the sediment deposition and/or transport cycle on a local scale;

0.51. The conservation of a coastal wetland is predicated on control of the activities having the greatest impact on it, such as channelization, use of runoff, dredging, logging or burning of vegetation, and grazing, as well as on maintenance of the hydrological function and water quality.

It is important to point out to the Secretariat that DGIRA, in its decision of 11 February 2008 (Appendix 13), gave conditional authorization to the LNG project and, on pp. 140–143, condition 3, again requested a water balance study "giving a full demonstration of the impacts of the extension of Tepalcates Canal and resultant water flow toward the four ponds of the lagoon." Thus it is clear that the competent authority never obtained the studies necessary to conduct its assessment, much less to ensure the absence of impact on this important coastal wetland, which is gravely and irreversibly harming the ecosystem as a whole.

2.16. Originally, no linkage was made with planning documents and the applicable legal instruments, such as PROETSLC and NOM-022-Semarnat-2003, as is required under Article 13, subsection III of the LGEEPA Environmental Impact Regulations. The promoter proceeded in this fashion without any additional information being asked of it until the state Government amended the PROETSLC.

2.17. In accordance with Article 4-IV of the LGEEPA Environmental Impact Regulations, a public information meeting was held on 19 December 2006, in the city of Manzanillo at the request of BIOS-IGUANA, A.C. and other citizens. In this meeting, the project's sustainability was questioned. However, the CFE did not demonstrate the technical viability of its project, as required by law.

2.18. On 23 January, by way of official communication S.G.P.A./DGIRA/DG/0175/07, Semarnat's DGIRA requested additional information from the CFE. This request did not require the CFE to justify the TGNLM project, which is industrial in nature, in the context of the PROETSLC, which concerns a zone where land use is reserved for conservation, protection and restoration.

2.19. On 2 February 2007 an amendment to the Chapter on "Species and Populations at Risk and Prioritized for Conservation" of the General Wildlife Act (*Ley General de Vida Silvestre*), incorporating Article 60, came into force. It stipulates: ***"Shall be prohibited the removal, filling, transplanting, pruning, or any other works or activities that affect the integrity of the mangrove's hydrologic cycle, that of its ecosystem and zone of influence;*** *that of its natural productivity; that of the ecosystem's natural carrying capacity for tourism projects; that of its nesting, reproduction, refuge, feeding and fry rearing areas; or which affect the interactions between mangroves, rivers, dunes, the adjacent maritime zone and coral, or which provoke changes in ecological characteristics and services."*

2.20. However, the DGIRA did not take this new provision into account, which prohibits the development of a project like the TGNLM, since it is located in a mangrove zone and would significantly modify the hydrologic cycle of the mangrove ecosystem in Laguna de Cuyutlán were it to be implemented.

2.21. On 4 May 2007, the CFE provided the DGIRA, by way of official communication 7B/2007/JMRA-00237, with the additional information (see Appendix 14) requested by Semarnat on 2 February 2007 via official communication S.G.P.A./DGIRA/DG/0175/07 (see Appendix 15). This information was not delivered in a timely manner. Article 22 of the LGEEPA Environmental Impact Regulations specifies that the date of delivery of such additional information may not exceed a term of 60 days following notification; and that once such a period has ended, the environmental impact assessment process shall be declared expired, in the event the promoter fails to deliver the information requested.

2.22. The additional information referred to in the foregoing point was incomplete, as the DGIRA itself mentioned, in its whereas clause XLII of the authorization dated 11 February 2008. On 6 July 2007, the CFE provided details on environmental matters in response to a request for additional information, specifically: the coast line, dredging, hydraulic control works, sea turtles, sediments, mangroves, INF criteria 20, irregular settlements, sodium hypochloride, disposal of dredged materials, paragraph 4.0 of NOM-022-Semarnat-2003 and its diagnostic of the lagoon.

2.23. On 21 May 2007, via official communication S.G.P.A./DGIRA/DESEI/0712/07 (Appendix 16), the DGIRA informed the CFE of its decision to extend the deadline by sixty days, on a one-time only basis, due to the complexity of the TGNLM project, as is permitted under the LGEEPA's Article 35, final paragraph, and Article 46 of the LGEEPA Environmental Impact Regulations. However, the authorization was issued beyond the legally permitted period, i.e., on the late date of 11 February 2008, six months after the established deadline. This therefore constituted a violation of the LGEEPA, the LGEEPA Environmental Impact Regulations and the Federal Administrative Procedure Act (Article 60).

3. FACTS REGARDING THE ADMINISTRATIVE PROCEDURES AND LEGAL ACTIONS BROUGHT AGAINST THE RESPONSIBLE AUTHORITIES

3.1. On 3 August 2006, Margarita Bataz Navarro appealed for review of the LPG supply project developed by Zeta Gas del Pacífico S.A. de C.V. On 10 June 2009, following an *amparo* action, Semarnat upheld its authorization (Appendix 19).

3.2. On 11 October 2005, Gabriel Martínez Campos wrote to the Minister of Social Development requesting its intervention in resolving the issues of the residents of Laguna de Cuyutlán. On 9 December, Semarnat replied to the request (Appendix 20).

3.3. On 24 May 2007, Esperanza Salazar Zenil, Margarita Batáz Navarro, Benjamín López Campos, América Moreno Cárdenas, and Timoteo Velasco Campos filed in State of Colima Tax and Administrative Court (*Tribunal Contencioso Administrativo*) for nullity of the order revising the ecological zoning program of the Laguna de Cuyutlán sub-basin. After two years and four months, the Judge dismissed the action (Appendix 21).

3.4. On 5 September 2007, Esperanza Salazar Zenil requested that the DGIRA declare the process for assessing the environmental impact and risk of the "Manzanillo Liquefied Natural Gas Terminal" project expired (name under which it is registered on page 13, numeral L of its authorization), as under the LGEEPA Environmental Impact Regulations, the DGIRA was required to conclude its assessment by 24 August 2007, at the latest. No response to this request was ever forthcoming.

3.5. On 28 April 2008**,** Esperanza Salazar Zenil lodged a complaint with the Civil Service Commission (*Secretaría de la Función Pública*) against the Secretary of the Environment and Natural Resources, Juan Rafael Elvira Quezada; the Under- Secretary, Mauricio Limón Aguirre; the Director General for Environmental Impact and Risk, Eduardo Enrique González Hernández; the Director General for Environmental Policy, Antonio Díaz de León; and the local Semarnat official in Colima, in relation to the illegal authorization of the TGNLM project. This complaint was ignored.

3.6. On 14 May 2008, Esperanza Salazar Zenil lodged a complaint with the Federal Justice Department's Special Investigations Unit for Crimes Committed by Public Servants (*Unidad Especializada de Investigación de Delitos Cometidos por Servidores Públicos de la Procuraduría General de la Republica*) against the Secretary of the Environment and Natural Resources, Juan Rafael Elvira Quezada; the Under- Secretary, Mauricio Limón Aguirre; the Director General for Environmental Impact and Risk, Eduardo Enrique González Hernández; the Director General for Environmental Policy, Antonio Díaz de León; and the local Semarnat official in Colima, in relation to the illegal authorization of the TGNLM project. This complaint was not attended to.

3.7. On 26 March 2008, Benjamín López Campos appealed to Semarnat for review of the "Manzanillo Liquefied Natural Gas Terminal" project. Following an *amparo* action, on 24 March 2009, Semarnat upheld its authorization (Appendix 22).

3.8. On 4 June 2008**,** Esperanza Salazar Zenil and Gabriel Martínez Campos brought an amparo action at the District Court in the state of Colima against the official at table 3 of the Justice Department of the state of Colima and the Attorney General, Arturo Díaz Rivera, for failing to initiate the preliminary inquiries into the complaint referred to in the immediately preceding point, as well as against the Governor of the state and other officials. This amparo action prospered. However, prosecutors have not put forth a precise description of the actions or omissions that are considered offenses in this case.

3.9. On 15 June 2008, the CFE started the work without having complied with the conditions, specifically condition 3 and its subparagraphs (water balance study) and condition 16 of Semarnat doc. no. S-G-P-A-/DGIRA/DSEI/0591/08 of 28 May 2008 (Appendix 23). It should be noted that six months after the authorization of the project, the most important study for determining the impact on Laguna de Cuyutlán that will be caused by alteration of the water budget has not yet been conducted, nor have the conditions been complied with, as is evident from the CFE's first semiannual administrative report, doc. no. ROMZ-341/08, of 6 August 2008 (Appendix 23-A), sent to Profepa. We reemphasize that the project commenced on 15 June 2008.

3.10. On 10 July 2008, Esperanza Salazar Zenil lodged a complaint with Profepa concerning the commission of environmental damages by the CFE in the area of the TGNLM project, a project that went ahead despite the CFE's failure to comply, to date, with the conditions established in the authorization of 11 February 2008. Profepa responded that the project was already authorized without, however, reviewing compliance with said conditions.

STATUS OF THE PROJECTS

3.11. Installation of infrastructure in the Manzanillo LPG project began in September 2004. The storage facility, consisting of 20 spheres (Appendix 24, photos 1 and 2) is practically completed and is now operating, with 40 trucks daily. This project has dramatically affected the landscape and severely impacted the habitat of mammals, reptiles (including green and black iguanas and three species of marine turtle, all listed in NOM-059-SEMARNAT-2001), and local and migratory birds, especially shorebirds. In addition, the project developers intend to install a 327-km gas pipeline that will have severe impacts on 25 municipalities of the states of Colima and Jalisco.

Construction on the LNG project commenced on 15 June 2008, beginning with the clearing of a wide area of palms, fruit trees, and native species (Appendix 24, photos 3 and 4). This was followed by filling of a 400 m by 100 m area of the lagoon starting from the mangrove edge (Appendix 24, photos 5, 6, and 7), causing severe harm to species of fish, crustaceans, mollusks, and benthos and having considerable impacts on inshore fishing. To this may be added an irreversible alteration in the water balance from which damage to the entire wetland will ensue. The worst is yet to come, since the developer plans to extend the Tepalcates Canal (Appendix 24, images 8 and 9) from its current length of 90 m to 400 m. Furthermore, it will dredge both the canal and the lagoon to a depth of 16 m. This will produce major changes in the water balance of the lagoon's four ponds. It will also alter the salinity of the water, irreversibly affecting the existing mangrove ecosystem throughout the whole wetland. Finally, the developer will install a gas pipeline running through 25 communities of Colima and Jalisco, affecting two wetlands of great biological value in the latter state.

3.12. We wish, further, to point out to the Secretariat that the CFE and the University of Colima are responsible for compliance with the environmental law, since in producing the EIS, they should have taken account of all environmental laws, regulations, and provisions of all kinds, and analyzed their relationship to the project. This did not happen; specifically, they failed to comply with the ecological zoning plan of 2003, and evaded their technical/scientific responsibility by ignoring points 0.15, 0.16, 0.17, 0.18, 0.20, 0.22, 0.43, 0.44, 0.48, and 0.51 of the preamble to NOM-022.

0.17. Any economic activity must take account of the full range of services and functions provided by coastal wetlands, in both the environmental impact studies and the ecological zoning, with a view to circumscribing the negative impacts of close or distant alterations due to human and natural activities.

IV. CONCLUSION: This complaint lodged against all three levels of the Government of Mexico bears on what constitutes a flagrant violation of: Article 4 of the Political Constitution of the United Mexican States; Articles 1 to 4 of the Ramsar Convention on Wetlands, especially concerning waterfowl habitat, which under Article 133 is the Supreme Law of the Republic; and of Mexican environmental acts and regulations applicable to Laguna de Cuyutlán, Colima. As a consequence, we request that the Commission for Environmental Cooperation of North America intervene in order to declare its support for securing the due protection of this area.

V. CITIZEN SUBMISSION: Please acknowledge the present citizen submission and act upon it in accordance with provisions of Articles 14 and 15 of the NAAEC and other related and applicable articles.

Gabriel Martinez Campos
President, Bios Iguana A.C.

Esperanza Salazar Zenil

Appendix 3
Environmental Law in Question

General Ecological Balance and Environmental Protection Act[1]

Article 30. In order to obtain the authorization contemplated in Article 28 of this Act, interested persons shall submit to the Ministry an environmental impact statement which shall contain, at least, a description of the possible effects on the ecosystem or ecosystems that may be affected by the work or activity in question, considering the sum total of the elements making up said ecosystems as well as the preventive, mitigation, and other measures necessary to avert and/or minimize the negative effects on the environment.

Where the activities in question are considered high-risk pursuant to this Act, the statement shall include the applicable risk study.

Where modifications are made to the plan for the work or activity in question subsequent to the filing of an environmental impact statement, the interested persons shall notify the Ministry thereof so that the latter may, within a period not to exceed ten days, notify them whether the submission of any additional information is necessary in order to assess the potential environmental impacts of the modifications, as prescribed by this Act.

The contents of the preventive report as well as the characteristics and modalities of the environmental impact statements and risk studies shall be established by the Regulation to this Act.

[Article amended DOF 12/13/1996]

Article 35. Upon the filing of an environmental impact statement, the Ministry shall initiate the assessment procedure, for which purpose it shall verify that the application meets the formalities prescribed by this Act, its Regulation, and the applicable Mexican official standards, and shall open the corresponding file within a period not to exceed ten days.

For the authorization of the works and activities to which Article 28 refers, the Ministry shall adhere to the provisions of the aforementioned instruments, as well as the urban development and environmental land use plans, protected natural area declarations, and such other legal provisions as may be applicable.

In addition, for the authorization to which this article refers, the Ministry shall assess the possible effects of the said works or activities on the ecosystem or ecosystems in question, considering the sum total of the elements of which they are composed and not only the resources that would be subject to use or impact.

Having assessed the environmental impact statement, the Ministry shall, with a basis in law and fact, issue the corresponding decision in which it may:

I. Authorize the work or activity in question, as per the application;

II. Authorize the work or activity in question, conditional upon the modification of the project or the establishment of additional prevention and mitigation measures aimed at preventing, lessening, or offsetting the adverse environmental impacts likely to be produced during construction and normal operation or in the event of an accident. In the case of conditional authorizations, the Ministry shall specify the requirements to be observed in the performance of the planned work or activity, or

1 DOF, 28 January 1988.

III. Deny the requested authorization, where:

a. it involves a violation of this Act, its regulations, the Mexican official standards, or any other applicable provisions;

b. the work or activity in question could lead to one or more species being declared threatened or endangered or where there is any impact on such species, or

c. the information provided by the applicants in regard to the environmental impacts of the work or activity in question is false in any way.

The Ministry may require the posting of security or bonds to ensure compliance with the conditions set out in the authorization, in those cases expressly enumerated in the regulation to this Act, where serious harm to ecosystems could occur while the works are being carried out.

The decision of the Ministry shall refer only to the environmental aspects of the works and activities in question.

[Article amended DOF 12/13/1996]

Environmental Impact Assessment Regulation to the General Ecological Balance and Environmental Protection Act[2]

Article 13. The environmental impact statement, in its regional form, shall contain the following information:

[…]

III. Relationship to the applicable planning instruments and legal provisions;

[…]

General Wildlife Act[3]

Article 60 *ter.* The following are prohibited: removal, filling, transplanting, cutting, or any activity that affects the integrity of water flow in the mangrove area; the ecosystem and its area of influence; its natural productivity; the natural carrying capacity of the ecosystem for tourism projects; any nesting, breeding, refuge, feeding, and spawning grounds; or interactions between the mangrove area, rivers, dunes, the adjacent coastal zone, and corals or that cause changes in ecological characteristics and services. Works or activities whose purpose is to protect, restore, research, or conserve mangrove areas shall be excepted from the prohibition contained in the preceding paragraph.

Mexican Official Standard NOM-022-SEMARNAT-2003, Establishing the specifications for the preservation, conservation, sustainable use, and restoration of coastal wetlands in mangrove zones[4]

[Only the relevant sections of the standard are cited.]

…

2 DOF, 30 May 2000.

3 DOF, 3 July 2000.

4 DOF, April 10 2003.

1.0 Object and scope of application

The scope of application of this Standard is mandatory for every user in the watershed, within the framework of the overall management plan for the watershed.

1.1 The object of this Mexican Official Standard is to establish the specifications that shall regulate sustainable use in coastal wetlands with a view to preventing their deterioration and promoting their conservation and, as applicable, their restoration.

1.2 For the purposes of this Standard, coastal wetlands are understood to be the complete hydrological units that contain mangrove plant communities.

1.3 The provisions of this Mexican Official Standard shall be observed by the persons responsible for the performance of those works or activities that are intended to be sited in coastal wetlands or that, by virtue of their characteristics, may have negative impacts on coastal wetlands.

[…]

4.0 Specifications

4.1 The mangrove woodland shall be preserved as a plant community. In the assessment of applications related to land use change, wildlife harvest authorization, or environmental impact, in every case the integrity of the mangrove woodland shall be guaranteed, and for such purpose the following points shall be contemplated:

i. The integrity of the water flow of the coastal wetland;

ii. The integrity of the ecosystem and its zone of influence on the continental shelf;

iii. Its natural productivity;

iv. The natural carrying capacity of the ecosystem for tourists;

v. The integrity of nesting, breeding, refuge, feeding, and spawning areas;

vi. The integrity of the functional interactions among coastal wetlands, rivers (surface and underground), dunes, the adjacent marine zone, and corals;

vii. Change of ecological characteristics;

viii. Ecological services;

ix. Ecological and ecophysiological aspects (structural aspects of the ecosystem such as depletion of primary processes, physiological stress, toxicity, high incidence of migration and mortality, as well as population decline, primarily for those species having status, among others).

4.2 Any canal building, flow interruption, or water diversion work that jeopardizes the ecological dynamics and integrity of coastal wetlands shall be prohibited, except in such cases where the described works are designed to restore circulation and promote the regeneration of the coastal wetland.

4.3 The developers of a project requiring the existence of canals shall perform prospecting with the intention of detecting existing canals that may be used so as to avoid ecosystem fragmentation, saline intrusion, silting, and alteration of water balance.

4.12 The environmental impact studies and the ecological land use plans shall consider the balance between water inflow from the continental watershed and water inflow from tides, which determines the mixture of fresh and salt water that creates the estuarine conditions essential to the survival of coastal wetlands and the plant communities they support.

4.23 In cases where canal building is authorized, the mangrove area to be deforested shall be exclusively restricted to that which is approved in the environmental impact decision and the forest land use change authorization. The diversion or straightening of natural channels or of any portion of a hydrological unit, whether or not it contains mangrove vegetation, is prohibited.

[…]

4.33 The construction of canals shall ensure that the ecosystem is not fragmented and that the canals will allow for its continuity; preference shall be given to works or infrastructure development that strive to reduce the number of canals in mangrove woodlands.

4.37 The natural regeneration of the hydrological unit and of plant and animal communities shall be favored by means of the restoration of the water balance and of continental water flows (surface and underground rivers, year-round and intermittent streams, sheet-flow runoff, water table contributions), the elimination of dumping of untreated wastewater protecting those areas showing potential for it.

4.38 Programs and projects for mangrove restoration shall have a sound scientific and technical basis and shall be approved in the environmental impact decision after consultation with a panel of experts. Such projects shall have a protocol serving as a guideline for determining the actions to be carried out.

[…]

4.42 Environmental impact and land-use planning studies shall consider a comprehensive study of the hydrological unit in which the coastal wetlands are located.

Appendix 4

Analysis of the LPG Terminal and the LNG Terminal projects with respect to the PROETSLC

Note: For ease of reading, the acronyms and definitions used here are defined in the main section of the factual record.

Introduction

This appendix presents detailed information on land use consistency with respect to the Regional Ecological Zoning Plan for the Cuyutlán Lagoon Subwatershed approved in 2003 (PROETSLC 2003) and modified in 2007 (PROETSLC 2007). For more information, the reader may also consult section 4 of the Factual Record.

1. The LPG Terminal and the PROETSLC 2003

The LPG Terminal project site is characterized by the presence of coastal dunes. These constitute an ecosystem of vital importance for the conservation of animal and plant species, since they generally provide habitat for endemic species or species with protected status; they contribute to the maintenance and regeneration of beaches (sediment reserves, aquifer recharge), and they act as buffers, absorbing the energy associated with hydrometeorological phenomena (strong wave action) and diminishing their impact on human settlements and land ecosystems near the coast. The dune systems consist of mounds of sand of highly variable height ranging from centimeters to dozens of metres. These ecosystems are fragile and result from the sediment budget, which is a function of complex biophysical processes.[1]

The landscape of UGA $Ent_5$39 consists of high, steeply sloping dunes (10–25 m) on unconsolidated sand with sandy coast halophilic vegetation. This highly fragile unit constitutes the source of sand for the beach along the entire barrier island bordering Cuyutlán Lagoon to the south.

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Coastal dunes form protective barriers that buffer the impact of weather and water phenomena on human settlements and adjacent land ecosystems.

UGA $Ent_4$40 is composed of a sand bar dividing the Cuyutlán Lagoon from the Pacific Ocean on the south side. Its highly fragile landscape is distinguished by coastal wave patterns and as the egg laying site for various turtle species. The recommended type of tourism is low-impact (ecotourism).

The land use for UGAs $Ent_5$39 and $Ent_4$40 corresponds to "terrestrial natural space" and is compatible with uses for flora and fauna. The tourism land use is conditional low-impact tourism or ecotourism, although an expert consulted by the Secretariat recommended that more detailed studies be conducted in order to devise a state policy providing for both medium- and long-term sustainable tourism development for local benefit and conservation of Cuyutlán Lagoon.[2]

Among the criteria defined for UGA $Ent_5$39, infrastructure and equipment activities are incompatible. In UGA Ent440, equipment is one among several incompatible activities, which contrasts with the infrastructure deriving from the project execution.

1 Semarnat, Environmental Policy and Regional and Sectoral Integration Division (Dirección de Política Ambientale Integración Regional y Sectorial) (2013), Manejo de ecosistemas de dunas costeras: Criterios ecológicos y estrategias, online at <http://goo.gl/8j9xZH> (viewed 15 October 2015).

2 Rogelio Zizumbo, "Análisis del procedimiento de evaluación de impacto ambiental de los proyectos gas LP y GNL Manzanillo, Colima. Vinculación con los ordenamientos de planeación aplicables en materia ambiental y urbano" (February 2015).

The ecological zoning criterion applicable in UGAs Ent539 and Ent440 is Ent 2, in which disturbed areas must be incorporated into a restoration scheme allowing for natural recovery of the vegetation, however, the AIA-LPG authorized the clearing of over 150,000 m^2 of fruit trees (coconut, mango, lemon, tamarind, etc.) and an impact on the dune vegetation over an area of around 3.4 ha.[3]

UGA $Ag_3$26, classified as for agriculture and covered by a policy of use, is situated along the whole Cuyutlán coast. It consists of a strip over 1 km wide in the southeastern part, narrowing to 500 m towards the northwest. It is characterized by containing the majority of the coconut groves and being very low and flat, with mounds ranging up to 2 m high. There is occasional flooding of its sandy clay marsh soils and mangrove ecosystems situated on solonchak soils. A portion of the vegetation in the area is halophilic and shrubby, with salinas on hydromorphic soils.

Concerning UGA $Ag_3$26, its predominant use is for agriculture, its compatible use is for livestock, its conditional use is for human settlements, and its incompatible uses are infrastructure and equipment, among others.

The ecological zoning criteria for land use in UGA $Ag_3$26 that are applicable to the project are shown in Table A4-1.

Table A4-1: UGA $Ag_3$26 ecological zoning codes and criteria

Ecological zoning code and criterion	Notes
Ff 10. Cutting or clearing of shoreline vegetation along bodies of water, vegetation in mangrove ecosystems, and halophilic or riparian vegetation is prohibited.	The beach where the project is sited is an occasional turtle nesting area (see note in Ff 17).
Ff 12. The alteration of egg-laying areas of amphibians, reptiles, and birds is prohibited.	Protection
Ff 13. All activities carried out in this UGA must preserve the structure, size, and stability of cage bird and songbird populations.	A wooded area of over 150,000 m^2 was cleared, reducing the habitat for these bird species.
Ff 16. Land uses in areas adjacent to turtle nesting beaches are subject to environmental impact approval further to a demonstration that there is no impact on nesting.	The project underwent environmental impact assessment.
Ff 17. The only infrastructure allowed on turtle nesting beaches is that which is used for management of the species.	The AIA-LPG refers to a technical opinion issued by the Colima State Department of the Environment (*Dirección de Ecología*) of the stating that a large number of marine turtles come ashore here during egg- laying season.[4]
Ff 21. Physical or chemical alteration of dunes and beaches in turtle nesting areas is prohibited.	The AIA-LPG states that there is occasional turtle nesting on the beach, and mentions impacts on 3.4 ha of dune vegetation.
Ff 40. Areas subject to environmental offsetting in mangrove ecosystems may not be used for any economic activity.	The project did not involve cutting any mangroves.
Ff 41. Resource use, cutting, or filling in a mangrove ecosystem is strictly prohibited.	The project did not involve cutting any mangroves.
Ent 2. See discussion in section 1 above related to UGAs $Ent_5$39 and $Ent_4$40	

3 Regional form of the environmental impact statement for the LPG Terminal project, filed by Zeta Gas del Pacífico, S.A. de C.V. with the DGIRA on 24 February 2004 [EIS-LPG], at 3–5, 9; environmental impact and risk approval for the *Planta de Suministro de Gas L.P. en el municipio de Manzanillo, Colima* project, in file no. S.G.P.A./DGIRA/DEI.-1443.04 (23 June 2004), issued by the DGIRA to Zeta Gas del Pacífico, S.A. de C.V. [AIA-LPG, at 21.

4 Environmental impact and risk approval for the *Manzanillo Liquid Natural Gas Terminal* project (LNG Terminal), in file no. S.G.P.A./DGIRA.DG.0464.08 (11 February 2008), issued by the DGIRA to the CFE [AIA- LNG], at 15.

2. The LNG Terminal and the PROETSLC 2003

Comprising the barrier island at the southern end of basin II, UGA Ff_4 17 is classified for flora and fauna and has a designated protection policy. This unit is characterized as a warm, sub-humid to semi-arid coastal plain on sandy or sandy mud deposits and volcanic and granitic rocks with vegetation characteristic of a sandy coastline, subcoastal shrubland, mangroves, coconut plantations, and facilities. The compatible use is as a terrestrial natural space and the conditional uses are agriculture, human settlements, equipment, and infrastructure, while the incompatible use is mining. Although this UGA allows equipment and infrastructure, it is covered by a protection policy. The criteria applicable for land use in this UGA are Ent 1, 2, 5, 6 and are described in Table A4-4.

UGA Ff_4 17 occupies the barrier island at the south end of basin II and its predominant use is for flora and fauna. For this UGA, the PROETSLC 2003 establishes terrestrial natural spaces as a compatible use. The conditional uses are agriculture, human settlements, equipment, and infrastructure; the incompatible use is mining.

UGA If_3 42 is classified for infrastructure, since this is the site of the Tepalcates Canal, and it has a designated policy of use. The compatible use is fishing; the conditional use is tourism, and the incompatible uses are industry and aquaculture. The project did not anticipate any installation of equipment in this UGA, but it did plan to expand the existing infrastructure. Some of the most important applicable land use criteria are described in Table A4-2.

Table A4-2: Most important UGA If_3 42 ecological zoning codes and criteria relating to the LNG Terminal

Ecological zoning code and criterion	Notes
If 1. The installation of any type of infrastructure, with the exception of that which is necessary for protection, environmental education, and research activities, is prohibited.	According to the EIS-LNG submitted by the developer, no new infrastructure was planned, only the widening of the existing infrastructure. However, new infrastructure (breakwaters, turning basin, and docking facility) was installed for the canal.[5]
If 24. Works and activities that affect aquatic flora and fauna communities are not permitted.	The project affected mangrove species and the water balance in the lagoon.[5] It also included dredging, which eradicated benthic communities from the lagoon.[7]
If 67. The construction of road infrastructure requires environmental impact assessment and approval by the competent authority.	The project underwent environmental impact assessment.
If 73. Access roads must have speed bumps and fauna protection signage.	
If 100. Roads, walkways, and parking areas must be paved with materials that allow for storm water infiltration into the subsoil and be equipped with adequate drainage.	Contemplated in the design.

Finally, UGA Ff_4 43, classified as for flora and fauna and covered by a conservation policy, is a large mangrove area affected by the widening of the Tepalcates Canal. This UGA is characterized as a warm, sub-humid to semi-arid coastal plain on sandy or sandy mud deposits and volcanic and granitic rocks with vegetation characteristic of a sandy coastline, subcoastal shrubland, mangroves, coconut plantations, and facilities. The landscape is characterized by the presence of degraded subcoastal thornscrub. Terrestrial natural spaces are a compatible use while tourism is a conditional use. Other uses—human settlements, agriculture, livestock, equipment, and infrastructure—are incompatible. During the construction of the project, this UGA was partially affected. The ecological criteria applicable to these land uses are described in Table A4-3.

5 *Ibid.*, at 28, 80.
6 *Ibid.*, at 85.
7 *Ibid.*, at 31 and 90 (in relation to water balance) and at 89 and 91 (in relation to the benthos).

Table A4-3: UGA $Ff_4$43 ecological zoning codes and criteria relating to the LNG Terminal

Ecological zoning code and criterion	Notes
Ent 1, 2, 5, 6. Described in Table A4-4.	The developer stated that the inflow of marine water with the widening of the Tepalcates Canal would bring in larval forms of certain species, thus contributing to natural restocking. However, the opening of the canal is bringing in exotic species that may negatively affect the abundance of local or endemic species.
Ena 7. Restocking at strategic sites in order to increase species abundance is permitted.	While the project did not seek to expand the agricultural frontier, mangroves were removed in this area for the purposes of widening the Tepalcates Canal.
Ena 11. Thinning of mangroves to expand existing areas dedicated to agricultural and livestock activities in adjacent zones is prohibited.	The project underwent an environmental impact assessment.
Ena 14. The use of motor vehicles, and the number of such vehicles used, are subject to approval by the competent authority.	The project underwent environmental impact assessment.

In addition to the UGA described above, UGAs Ent539 and Ent440 are also applicable to the LNG Terminal project. The predominant use in these areas is as a terrestrial natural space, the compatible use is for flora and fauna, and the conditional use is for tourism, while other uses are incompatible. The ecological criteria applicable to these land uses are described in Table A4-4.

Table A4-4: UGA $Ent_5$39 and $Ent_4$40 ecological zoning codes and criteria relating to the LNG Terminal

Ecological zoning code and criterion	Notes
Ent 1. Any dredging or lagoon restoration work must undergo an environmental impact study.	An environmental impact assessment was conducted. Lagoon restoration is not envisaged.
Ent 2. Disturbed areas must be restored in such a manner as to allow for the natural recovery of the vegetation.	The LNG Terminal project contemplates impacts on an area zoned as a forest.[8]
Ent 5. Infrastructure interfering with lake dynamics may not be developed.	The proposed design, the approved design, and the built project all included widening and dredging of the Tepalcates Canal, dredging for the turning basins, and construction of breakwaters that altered the lake dynamics.
Ent 6. Any use of wetlands is subject to environmental impact approval further to a finding that the hydrological cycle, water quality, nutrient flow, and biodiversity will be maintained.	The modification of the wetland banks does not by itself guarantee water quality, nutrient flow, or biological diversity.

UGAs $Ac_4$31 and $If_3$42 have a designated policy of use that allows for certain infrastructure activities to take place. Nevertheless, the main objective of this policy is to reorient the manner in which the resources are used so as to conserve and increase the forest cover and not induce land use changes.

The predominant land use in UGA $Ag_3$26 is agriculture, with livestock as a compatible use and human settlements as a conditional use; the incompatible uses are mining, infrastructure, and equipment. The criteria applicable to UGA $Ag_3$26 are given in Table A4-5.

8 *Ibid.*, at 91.

Table A4-5: Most important UGA $Ag_3$26 ecological zoning codes and criteria relating to the LNG Terminal

Ecological zoning code and criterion	Notes
Ff 10. The cutting or clearing of shoreline vegetation along bodies of water, mangrove ecosystems, or halophilic or riparian vegetation is prohibited.	Construction of the project included the removal of a 5–15 m strip populated by mangroves (*Laguncularia racemosa* and *Rhizophora mangle*) and halophilic lowland forest and riparian species.[9]
Ff 12. The alteration of the egg-laying areas of amphibians, reptiles, or birds is prohibited.	The project was executed in areas where crocodile (*Cocodrylus acutus*) nesting was identified.[10]
Ff 13. All the activities carried out in this UGA must preserve the structure, size, and stability of song and cage bird populations.	The project developer stated that bird nesting areas would not be affected, since "the narrow strip constituted by the mangroves in the area [occupied by the project] does not harbor a forest community."[11] It stated that these sites are not generally frequented by songbirds. Since the modifications would not affect the marsh area, neither would they affect the food sources of migratory waterbirds. The closest area to the project with a significant concentration of birds is "Pelicanos," 2 km away from the project.[12] All things considered, the work on the breakwaters to widen the canal would affect flora and fauna, mangroves, tropical deciduous forest, and dunes. All these are nesting, protection, and resting sites for birds and wildlife.
Ff 16. Land uses in areas adjacent to turtle nesting beaches shall be subject to environmental impact approval demonstrating an absence of impact on nesting areas.	The environmental assessment took place; however, the construction of the Tepalcates Canal caused the disappearance of more than 400 m of beach front where turtle nests were located.
Ff 17. The only infrastructure permitted on turtle nesting beaches is for management of the species.	It is stated that the beach at the proposed project sites is not considered a priority marine turtle nesting beach; however, the developer stated that the beach adjacent to the west breakwater of the Tepalcates Canal harbored an average of 24 nests per kilometer of beach.[13]
Ff 20. The approval of activities on turtle nesting sites is subject to the management plan.	
Ff 21. Physical and chemical alteration of the dunes and beaches in turtle nesting areas are prohibited.	The project envisages "impacts on 6.09 ha of coastal dunes."[14] In addition, the Tepalcates Canal was widened to 460 m, 200 m more than reported in the EIS. The project contemplated that the opening of the canal would alter (by eliminating) at least 400 m of beach—a prohibited activity.
Ff 40. Areas subject to environmental offsetting in mangrove ecosystems may not be used for any economic activity.	
Ff 41. The use, cutting, or filling of mangrove ecosystems is strictly prohibited.	The project includes removal, deforestation, and alteration of the mangrove ecosystem, including the water balance of the lagoon.
Ent 1, 2, 5 and **6.** Described previously in Table A4-4.	

9 *Ibid.*, at 93–5, 100.
10 *Ibid.*, at 91.
11 *Ibid.*, at 72.
12 *Ibid.*
13 *Ibid.*, at 69.
14 *Ibid.*, at 84–5.

Aquaculture is the predominant use in UGA Ac431, however only part of the area of the Cuyutlán Lagoon basins is considered fit for this activity. Other activities in this unit include harvesting of scale fish, shrimp, and crab species, enclosure of native species, and low-impact tourism. According to the PROETSLC 2003, the opening of the Tepalcates Canal in 2000 reverted eutrophication levels in favor of the development of subaquatic life, but it is necessary for all activities on the site to be low-intensity and subjected to strict natural resource use regulations.

UGA $Ac_4$31 has equipment and infrastructure as compatible uses, tourism as a conditional use, and human settlements as incompatible. The ecological zoning criteria applicable to this UGA are described in Table A4-6.

Table A4-6: UGA $Ac_4$31 ecological zoning codes and criteria

Ecological zoning code and criterion	Notes
Ff 1,**4**, **5**,**7-41**. Described previously.	Only those applicable to the project are described.
Pe 12. Any activity or construction of infrastructure that alters natural current patterns within the environmental management unit is prohibited.	**The opening of the canal involved modification of infrastructure and dredging.**
Pe 19. Modification of natural water currents is not permitted.	As with the previous criterion, natural currents were altered by the canal widening and dredging.

3. LPG and LNG Terminals and the PROETSLC 2007

The PROETSLC 2007 lays down various environmental policies; the ones described in Table A4-7 are applicable to the project areas:

Table A4-7: Environmental policies applicable to the projects (PROETSLC 2007)

Use
Applies to areas with ongoing or potential economic uses as well as areas suited to urban development with policies of rational natural resource use. The use and management of natural resources is permitted.
Conditional port activity
The following are projected: construction of a port facility conditional on financing of the environmental services provided by the lagoon system and on measures to guarantee the conservation of basins III and IV; creation of a PNA including the upper part of the subwatershed and basin IV; financing of a restoration program for the UGAs, with protection and conservation guidelines; offsetting during the varous phases of the project; creation of an environmental fund.
Conservation
Indicated for those areas or natural features whose existing or proposed uses fulfill a relevant ecological function but do not themselves require inclusion in the National Protected Natural Areas System. These areas are well-preserved terrestrial-coastal ecosystems in which wildlife conservation projects (mainly focusing on turtles) are already in progress.
Restoration
Applies to areas exhibiting accelerated processes of environmental degradation, in which activities are necessary to reestablish conditions favoring the evolution and continuity of natural processes, including restoration of moist deciduous and oak forest ecosystems as well as protection of tropical deciduous forest. The restoration of these areas can focus on improving nonproductive ecosystems or land for purposes of use, protection, or conservation.

4. The LNG Terminal and the PROETSLC 2007

It may be noted that the project's area of influence encompasses UGAs 39 A Ei, 41 C EncLe, 26 A Apc, and 47 Rc EntLfe.

UGA 39 A Ei is an industrial and services area with an environmental policy of use. Road-related infrastructure, as well as urban, industrial, and service development are permitted. This can include developments such as highways, railways, roads, bridges, drinking water supply, and sewers; electricity generation, transmission, and distribution; warehousing and storage; pipelines and gas pipelines; port and wharf administration facilities; maritime loading and unloading services, and telecommunication and satellite services.

The criteria applicable to UGA 39 A Ei are human settlements (AH), infrastructure and equipment (Inf), industry and services (IN), and water management (MA).[15] The human settlement-related criteria are not applicable to the project, whereas the infrastructure, industry and services, and water management criteria allow for activities and infrastructure as well as the modification of the natural patterns of the UGA, provided that these works are subjected to an environmental impact assessment and comply with the applicable law. These criteria allow for activities related to the LNG Terminal project.

The lagoon area includes part of UGA 26 A Apc, an area designated for the construction of a port in basin II of Cuyutlán Lagoon. This scenario involves medium- and long-term state government projects, and the environmental policy is therefore that of port activities.[16] Notable features of this UGA are ecological criteria related to human settlements, which do not apply to this type of project.[17] It also includes a set of criteria governing port construction and activities, which focus on the new port facility and on tanker entry into basin II.[18] This UGA sets out various criteria applicable to infrastructure and equipment.[19]

UGA 41 C EncLe is a natural coastal space with economic activities mainly limited to ecotourism and having a designated policy of conservation. This UGA has ecological criteria covering the protection and conservation of flora and fauna, environmental education, tourism, infrastructure and equipment, water management, port construction and activities, as well as sustainable development, livestock production, and human settlements.[20] Among these criteria is Inf 27, described in Table A4-8. It should be noted that the Inf criteria permit infrastructure works provided that they undergo environmental impact assessment, comply with the applicable law, and implement restoration measures involving native vegetation.[21]

Table A4-8: Inf 27 criteria applicable to UGA 41 CEncLe

	Criterion	Notes
For any work or activity carried out in a mangrove ecosystem, it must be proven that it does not interfere with the following factors:	The natural laminar flow or natural patterns of circulation. The natural fluctuations of the flooded area of the river or watercourse, or of the tide or natural flood cycles. The natural flow of sediment and nutrients, or the natural water quality. The natural freshwater discharge from neighboring rivers or watercourses. The natural heights of the nearby tides. The natural water temperature and salinity.	The project alters the water balance of the lagoon and the flow of nutrients in the water. However, it invokes the premise that the widening of the Tepalcates Canal would positively alter the regional environmental system (see section 5 of this factual record).

15 Criteria described with codes AH12, INF2, INF3, INF7, INF20, INF21, IN2, IN3, IN4, IN5, IN7 and MA2.
16 See PROETSLC 2003, at 52.
17 For the record, the criteria in question are AH1, AH10, and AH12.
18 The criteria are PUE1, PUE2, PUE3, PUE4, PUE5, PUE6, PUE7, PUE8, PUE9, PUE10, and PUE11.
19 The criteria are INF2, INF3, INF10, INF11, INF12, INF13, INF14, INF15, INF16, INF19, INF20, and INF21.
20 The following criteria are applicable to this UGA: DS1, GA3, AH11, AH15, AH19, INF3, INF8, INF9, INF22, INF23, INF24, INF25, INF27, FFC2, FFC6, FFC9, FFC17, FFP1, FFP7, FFP14, FFP15, FFP16, FFP17, FFP18, FFP19, FFP21, FFP22, ED4, ED5, TU1, TU2, TU3, TU4, TU6, TU7, TU8, ED11, INF10, INF11, INF20, MA4, and PUE2.
21 The remaining criteria—sustainable development (DS), livestock (GA), human settlements (AH), tourism (TU), and environmental education (ED)—are not applicable given the nature of the project.

Photo A4-1: Artisanal fishing in the Cuyután lagoon

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Criterion Inf 8 allows the construction of infrastructure, provided that it does not affect coastal dune stability, water balance, or ecosystem functions. This criterion is also assessed in the EIS-LNG, which finds that the impacts would be positive due to the widening of the Tepalcates Canal. (For more information on this consideration, see section 5 of this factual record.)

UGA 47 Rc EntLfe, terrestrial natural space with limited economic activity, is primarily geared towards forestry and low-impact ecotourism. The environmental policy is restoration. The proximity of this area to inhabited areas makes it more vulnerable; the UGA provides for its restoration for purposes of conservation and for the establishment of forest-type environmental management units. Also, there is a hill between basins II and III that is a refuge for sea and land birds. This UGA establishes criteria of sustainable development, livestock production, tourism, human settlement, infrastructure and equipment, conservation and protection of flora and fauna, environmental education, water management, and port construction and activities.[22] The infrastructure criteria, which apply to the project, allow such activities to take place provided that they undergo environmental impact assessment. The flora and fauna criteria focus on natural resource conservation and protection; payment for environmental services (carbon capture and aquifer recharge) is promoted, and harvest of flora and fauna is prohibited.

22 The criteria are DS2, GA3, AC1, AH10, AH11, AH14, INF5, INF7, INF8, FFR1, FFR2, FFR4, FFR5, FFR6, FFR7, FFR8, FFR12, FFR13, FFC1, FFC2, FFC3, FFC4, FFC5, FFC6, FFC7, FFC8, FFC9, FFC10, FFC11, FFC13, FFP20, FFP1, FFP4,FFP5, FFP12, FOR1, FOR2, FOR3, FOR4, FOR5, FOR6, FOR7, FOR8, FOR9, FOR10, FOR12, FOR13, FOR14, FOR15, FOR17, ED2, ED3, ED4, ED6, ED7, ED8, ED9, MA2, MA4, INF10, INF11, MI1, MI4, MI5, MI6, and PUE2. The human settlements, livestock, sustainable development, environmental education, forestry, and mining criteria do not apply in the case of the LNG Terminal project.

Appendix 5
Diagnostic Study of the Cuyutlán Lagoon

Note: For ease of reading, the acronyms and definitions used here are defined in the main section of the factual record.

This appendix presents detailed information on hydrodynamics of the Cuyutlán lagoon. For more information, the reader may also consult Section 5 of the Factual Record.

1. General features of coastal lagoons

Coastal lagoons such as Cuyutlán constitute approximately 13% of the world's coastlines and are found on all continents except Antarctica. These ecosystems are defined as shallow coastal depressions (<10 m deep) parallel to the coast, temporarily or permanently connected to the ocean by one or more inlets, but separated from it by a physical barrier.[1]

Among the ecological characteristics of coastal lagoons is their connectivity, the control exerted over their processes by the balance between terrestrial and marine influences, and their ecological stability, in addition to its influence over salinity spatiotemporal fluctuations. Coastal lagoons are connected with freshwater environments (rivers, springs, aquifers), coastal environments (mangroves and marshland), marine environments (tides, currents), the atmosphere (climate), and the bottom (sediment); in short, they are open systems with many boundaries. The interaction between ecosystems takes the form of biogeochemical and biological processes regulated by hydrological processes acting over different spatiotemporal horizons.[2]

Moreover, marine processes (currents, tides, and waves), as well as freshwater inflow from inland, exert control over the ecological characteristics of coastal lagoons. These land-sea/sea-land controls relate to the balance of fresh water and seawater in these lagoons, which in turn determines the estuarine, marine, or hyperhaline conditions of each ecosystem. However, two more different salinity conditions may be found in the same coastal lagoon if its geomorphology is favorable to that situation or if it is modified.[3]

IN BRIEF

The basic concepts for the study and management of coastal lagoons are connectivity, land-sea/sea-land controls, and ecological stability.

Another characteristic of coastal lagoons relating to connectivity and land-sea/sea-land controls is their ecological stability, by virtue of which these ecosystems return to an equilibrium state after a disturbance; that is, these lagoons exhibit natural resilience. Due to land-sea/sea-land controls, coastal lagoons fluctuate in space and time, a fact reflected in their water quality, sediment distribution, and hydrodynamic parameters. The result is a diverse set of habitats with high biological productivity. Furthermore, coastal lagoons are considered to offer various environmental services, which have led to both the use and the abuse of these systems.[4]

However, natural events and anthropic activities alter the intensity of the connectivity between ecosystems and the relative magnitude of the land-sea/sea-land controls, and impact on the ecosystems' stability characteristics by altering their state of dynamic equilibrium. It is these characteristics that are considered to indicate the "health" of coastal lagoons, a concept used to facilitate interaction and discussion among researchers, natural resource administrators, and decision-makers.[5]

In this context, three concepts useful to the study and management of coastal lagoons have succeeded one another. The first, connectivity, posits the existence of interaction between ecosystems through biogeochemical and biological processes regulated by hydrological processes that act at different spatiotemporal scales. This ecohydrological

1 M.J. Kennish and H.W. Paerl, eds. (2010), *Coastal Lagoons: Critical Habitats of Environmental Change* (Boca Raton: CRC Press) [Kennish and Paerl 2010], online at <http://goo.gl/NYztpm> (viewed 20 August 2015), at 2; J.A. Herrera and O. Cortés Balam (2007), "Entre la tierra y el mar, las lagunas costeras de Yucatán," *Biodiversitas*, vol. 72 [Herrera and Cortés 2006], at 6; J.A. Herrera (2006), "Lagunas Costeras de Yucatán (SE, México): investigación, diagnóstico y manejo," *Ecotrópicos* (Sociedad Venezolana de Ecología), vol. 19, no. 2 [Herrera 2006], at 95, online at <http://goo.gl/nTZH3B> (viewed 8 October 2015).
2 Herrera and Cortés 2006, note 1 *supra*, at 7–8; Herrera 2006, note 1 *supra*, at 95.
3 Kennish and Paerl 2010, note 1 *supra*, at 3; Herrera 2006, note 1 *supra*.
4 Herrera and Cortés 2006, note 1 *supra*, at 7; Herrera 2006, note 1 *supra,* at 95.
5 Herrera 2006, note 1 *supra*, at 95.

connectivity is related to another concept, that of land-sea/sea-land controls, in which land-sea flows (from watersheds) and sea- land flows (from tides, currents, and hurricanes) are key to the regulation of the ecological functions of each ecosystem. These functions are related to the third concept, ecological stability, consisting of the resilience of an ecosystem—i.e., its return to an equilibrium state after a disturbance.[6]

Notable human activities in tropical coastal lagoons are tourism on the sandy beaches facing the ocean, ecotourism in the mangroves, aquaculture, fishing, and salt harvesting. In addition, coastal lagoons offer conditions for the siting of industry (thermal power plants, as in the case of Cuyutlán Lagoon, or shipping). For the purposes of these activities, many coastal lagoons were altered by structures such as bridges, roads, canals, etc., resulting in the alteration of their water circulation. With these developments, many coastal lagoons turned into dumping places for polluted and/or sediment-rich water, leading to eutrophication and silting. Rigorous monitoring and research programs have demonstrated that many coastal lagoons were converted from recreational areas and ecologically productive bodies of water into polluted ponds that no longer produce goods or services for the local communities. This, in addition, has created social conflict in the majority of cases.[7]

It has been pointed out that the Cuyutlán Lagoon, which accounts for 90% of the wetlands in the state of Colima, is the site of fishing and industrial activities, and provides critical migratory bird habitat.[8] However, Cuyutlán Lagoon has also experienced changes due to both natural processes and alteration of its characteristics (connectivity, sea-land/land-sea controls, and changes in natural spatiotemporal fluctuations), undermining its stability and ecological resilience and, as a consequence, reducing its potential to provide ecosystem services.[9]

1.1 Context of Cuyutlán Lagoon

Due to the connectivity, sea-land/land-sea controls, and ecological stability characteristics of coastal lagoons, the analysis of these ecosystems must include two spatial scales and one long- term temporal scale.[10] The spatial scales refer to the regional and local context of Cuyutlán Lagoon, while the long-term temporal scale relates to human activities historically carried out in this ecosystem for the purpose of using its services. The following paragraphs discuss the hydrological context of the lagoon and the anthropic disturbances it has suffered.

i. Local hydrology

The water level in Cuyutlán Lagoon is generally low in winter but begins to rise in April or May as a result of spring tides. The water level tends to rise with the onset of the rainy season, typically in June. As well, the occurrence of hurricanes normally causes the water level in the lagoon to rise.[11]

However, freshwater flows into Cuyutlán Lagoon are currently quite scarce and seasonal, mainly occurring during the rainy season.[12] It has been maintained that water from the Armería River used to enter the east side of the lagoon but that sediment buildup has redirected the water into the ocean. It has further been documented that this river water has been diverted for agricultural purposes since 1922.[13] When there are storm surges in the Armería River, its waters flood an area to the northwest of the river mouth and enter the Cuyutlán Lagoon through the Palo Verde salt marsh. The Las Adjuntas (or Zacate) and Agua Blanca creeks empty into the Cuyutlán Lagoon during the rainy season, but there is no available data on these discharges.[14] Other fresh water sources include a few small sinkholes that are apparently still flowing, although sporadically at best.[15] However, these sinkholes are probably much reduced due to the existence of agricultural wells in the area around the lagoon.[16] In this connection, the

6 *Ibid.*
7 Kennish and Paerl 2010, note 1 *supra*; Herrera and Cortés 2006, note 1 *supra*, at 7–8.
8 E. Mellink and M. Riojas López (2008), "Waterbirds (other than Laridae) nesting in the middle section of Laguna Cuyutlán, Colima, Mexico," *International Journal of Tropical Biology and Conservation* (Universidad de Costa Rica), vol. 56, no. 1 at 392; J. Torres and A.L. Quintanilla-Montoya (2014), "Alteraciones antrópicas: historia de la Laguna de Cuyutlán, Colima," *Investigación ambiental: Ciencia y política pública* (Mexico: Semarnat-INECC), vol. 6, no. 1 [Torres and Quintanilla-Montoya 2014] at 29–30.
9 E. Mellink and M. Riojas López (2007), "Modificaciones estructurales artificiales de Laguna Cuyutlán, Colima, México," *Revista Geográfica*, no. 142 [Mellink and Riojas López 2007], online at <http://goo.gl/nvgk4K> (viewed on 20 July 2015).
10 Jorge Herrera and Ismael Mariño Tapia, "Diagnóstico de los estudios de hidrodinámica elaborados por la Comisión Federal de Electricidad en relación con el proyecto Terminal de Gas Natural Licuado Manzanillo, Colima, preparado para la CCA" (April 2015) [Herrera and Mariño 2015].
11 Mellink and Riojas López 2007, note 9 *supra*, at 133, 135–6, p. 135.
12 *Ibid.*, at 136.
13 Federal Electricity Commission, Civil Engineering and Earth Sciences Office (*Gerencia de Estudios de Ingeniería Civil y Ciencias de la Tierra*—CFE-GEIC) (2010), *Informe final del estudio hidrológico de la cuenca del río Armería: Factibilidad de conexión entre el río Armería y el vaso IV de la laguna Cuyutlán* [CFE-GEIC Hydrological Study 2010].

EIS-LNG states that the only water flowing into Cuyutlán Lagoon is from El Zacate Creek.[17]

It has been maintained that Cuyutlán Lagoon used to have one or more natural outlets into the ocean, some of them permanent and others ephemeral; however, natural processes and the development of coastal infrastructure have eroded or simply eliminated these outlets.[18] At present, there are two areas where seawater interchange is still occurring: the Ventanas Canal in basin I and the Tepalcates Canal in basin II, both artificial.[19]

On the coast side, a homogeneous vertical movement induced by the tides (called "barotropic movement") has been recorded. The tides are mixed and predominantly semidiurnal, with two high waters and two low waters each lunar day.[20] The mean height of the tides is 0.60 m and the maximum height is 0.73 m. These tides generate coastal circulation which, through tidal ebb and flow, constantly renews the seawater in Cuyutlán Lagoon. However, the width and depth of the canals, their location, and the morphology and bathymetry of the lagoon must also be considered.[21]

Waves are continuous, exhibiting an elliptical path and a frequency of nine waves with respect to the larger wave. The currents exhibit a diurnal direction from northeast to southwest and an evening direction from southwest to northeast, with a velocity of up to eight knots depending on the season of the year. These currents are sufficiently powerful to effect longshore transport of sediment. As a function of the shape of the coastline and the angle of incidence, this mechanism is responsible for the opening and blocking of natural inlets and channels, except that it is not currently functioning, and so the connection between Cuyutlán Lagoon and the open ocean has to be maintained artificially.[22]

ii. Human activities and their impacts on the lagoon

The activities currently taking place in Cuyutlán Lagoon include industry (electricity generation, gas storage, port operations), tourism (mainly in Manzanillo and vicinity), salt harvesting, and fishing. Industrial activity is continuous while tourism is seasonal (April, June-July, December),[23] as is salt harvesting (February to June).[24] Fishing is continuous, although the species caught vary from season to season. Catch records fluctuate but there appears to be an overall decline in the lagoon's productivity.[25]

The main activities identified in this lagoon system are port operations, subsistence fishing, salt harvesting, guided boat tours of the mangroves, and agriculture.[26] It has been further maintained that the complete picture of the original hydrology of Cuyutlán Lagoon may never be known. Nevertheless, the principal artificial structural modifications have been documented since 1874, when an attempt was made to connect the lagoon to the Armería River. Other

14 INEGI (1995), "Estudio hidrológico del estado de Colima," National Institute of Statistics, Geography, and Informatics (*Instituto National de Estadística, Geografía e Informática*) [INEGI 1995]; A. Mena Herrera (1979), *Contribución al conocimiento de los factores que influyen en la productividad de la laguna de Cuyutlán, Col., con énfasis en el camarón,* undergraduate thesis, Universidad National Autónoma de Mexico, Mexico City.

15 G.B. Saunders and D.C. Saunders (1981), *Waterfowl and Their Wintering Grounds in Mexico, 1937–1964*, U.S. Department of the Interior, Fish and Wildlife Service, Resource Publication 139, Washington D.C. [Saunders and Saunders 1981].

16 Mellink and Riojas López 2007, note 11 *supra,* at 136.

17 *Idem.*

18 The lunar day is the period between moonrises at a specific point on Earth; EIS-LNG, note 17 *supra,* ch. IV, at 60.

19 Federal Electricity Commission, Civil Engineering and Earth Sciences Office (2012), *Informe final de hidrodinámica en el interior del sistema lagunar de Cuyutlán* [CFE-GEIC Final Water Balance Report], at 63; Federal Electricity Commission, Civil Engineering and Earth Sciences Office, Mexico, D.F. (2010), *Estudios para dar respuesta a las condicionantes emitidas por la DGIRA en el resolutivo de impacto ambiental para el proyecto de la Terminal de Gas Natural Licuado en Manzanillo, Colima* [CFE-GEIC Study on Conditions 2010]; CFE-GEIC Hydrological Study 2010, note 13 *supra*.

20 CFE-GEIC Final Water Balance Report. Also, concerning tide data, see *Manifestación de Impacto Ambiental para el proyecto Sitio de depósitos de material para el proyecto de dragado de la primera etapa de la laguna de Cuyutlán en Manzanillo, Colima* (no date (ca. 2007)), produced by Bios-Terra, S.C. for Dredging International, at 51, 80.

21 Federal Electricity Commission, Civil Engineering and Earth Sciences Office (2012), *Informe final de hidrodinámica en el interior del sistema lagunar de Cuyutlán* [CFE-GEIC Final Water Balance Report], at 63; Federal Electricity Commission, Civil Engineering and Earth Sciences Office, Mexico, D.F. (2010), *Estudios para dar respuesta a las condicionantes emitidas por la DGIRA en el resolutivo de impacto ambiental para el proyecto de la Terminal de Gas Natural Licuado en Manzanillo, Colima* [CFE-GEIC Study on Conditions 2010]; CFE-GEIC Hydrological Study 2010, note 13 *supra*.

22 CFE-GEIC Final Water Balance Report. Also, concerning tide data, see *Manifestación de Impacto Ambiental para el proyecto Sitio de depósitos de material para el proyecto de dragado de la primera etapa de la laguna de Cuyutlán en Manzanillo, Colima* (no date (ca. 2007)), produced by Bios-Terra, S.C. for Dredging International, at 51, 80.

23 Trading Economics, Mexico Tourist Arrivals in one year, online at: http://goo.gl/clnGhO (viewed on 18 May 2016).

24 J.C. Reyes (1995), "Las salinas colimenses durante el período colonial, siglos XVI a XVIII," in J.C. Reyes, comp., *La sal en México* (Colima: Universidad de Colima), 143–54.

25 EIS-LNG, note 17 *supra,* ch. IV, at 317.

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Industrial activities, low- intensity tourism, salt harvesting, and subsistence fishing take place in Cuyutlán Lagoon.

modifications have included the opening of an outlet in the southeast portion of the lagoon in the 1930s to drain it and control water levels for the salinas; the construction, in 1889, of a railway embankment crossing basin I, as well as a 3-metre-wide tunnel under the city of Manzanillo built in 1932. The Ventanas Canal, which is 80 m wide at its northwest end, was built in 1978 to supply cooling water for the generators of the Manzanillo Thermal Power Complex. In 2000, the Tepalcates Canal was reopened to increase water interchange between the lagoon and the ocean; it soon became silted up and had to be dredged in 2006 (see Table A5-1 and Figure A5-1).[27]

Until 1850, water circulation in Cuyutlán Lagoon was obstructed by a set of artificial structures related to salt harvesting. The sole remaining significant salt harvesting dam was built in the early twentieth century. This dam diminishes flow between basins III and IV, but the water overtops it at many points. In 2007, the salt producers built

Photo A5-1: Salt harvesting in Cuyutlán Lagoon

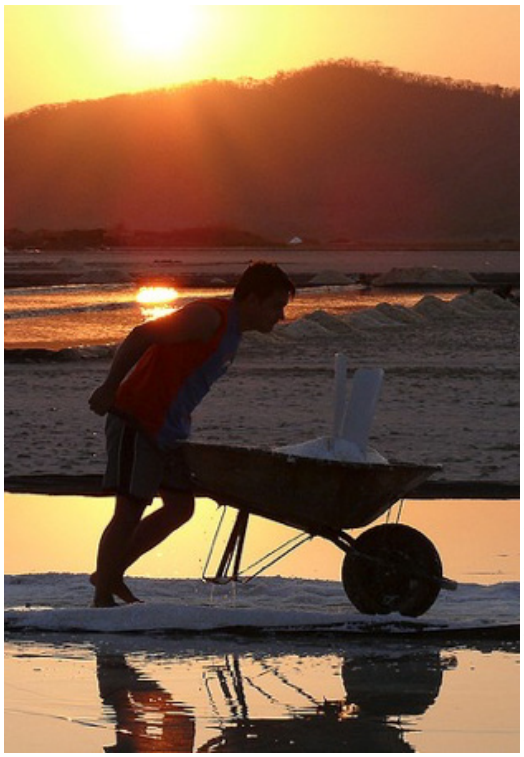


Photo: Courtesy of Víctor de la Rocha, at <www.flickr.com>.

a road between basins III and IV to carry salt to the village of Cuyutlán. There are other structures affecting water flow in the lagoon, such as the railway embankment between basins I and II, the transmission towers in basin I, and an embankment built to support the dredged sediment discharge pipes leading from the port of Manzanillo (see Table A5-1 and Figure A5-1).[28]

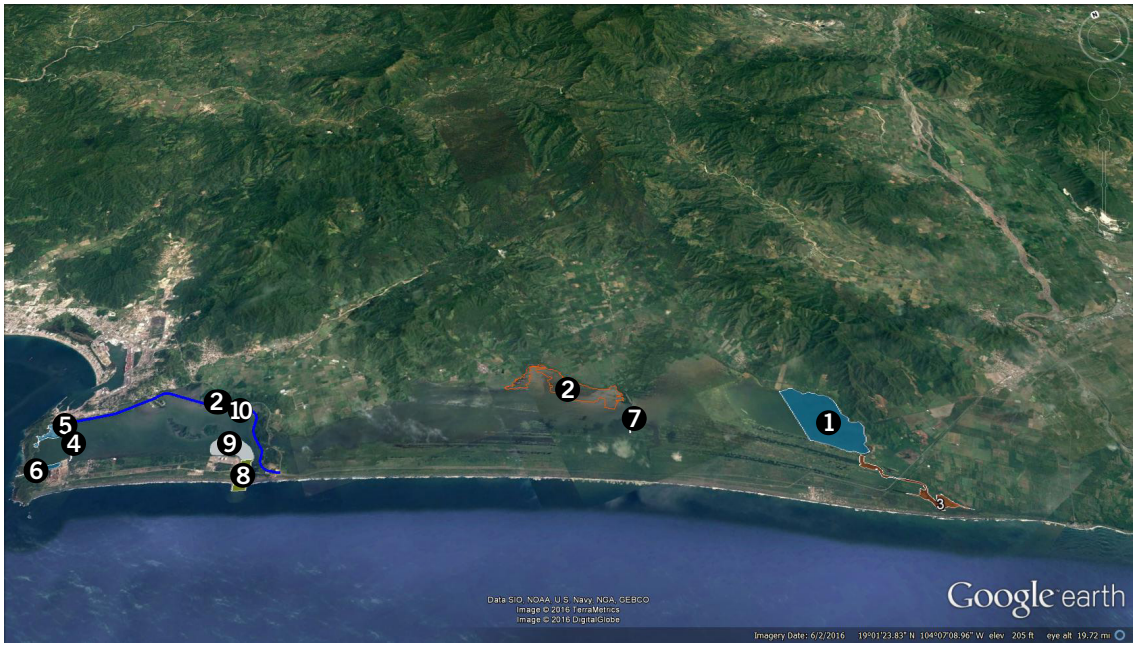
26 Industrial activities, low- intensity tourism, salt harvesting, and subsistence fishing take place in Cuyutlán Lagoon.
27 Mellink and Riojas López 2007, note 11 *supra,* at 137–139.
28 *Ibid.,* at 138–9.

Table A5-1: Historical activities and infrastructure in Cuyutlán Lagoon[29]

Year	Works or actions	Consequences
500-600 C.E.	Construction of rustic gates to maintain a certain volume of water, increase evaporation, and obtain salt. These activities took place throughout the lagoon.	Water balance alteration mainly in basins III and IV. Land use change; changes in plankton, benthos, and nekton communities in the salt harvesting areas.
1868	First canal connecting Manzanillo Bay to the Cuyutlán Lagoon opened as part of a port cleanup project.	Water balance alteration mainly affecting basin I; changes in water quality and in plankton, benthos, and nekton communities.
1870	Natural outlet from Cuyutlán Lagoon to the Pacific Ocean begins to disappear.	It becomes impossible to navigate between the Manzanillo lagoon and the Armería River with shallow-draft vessels; hypersaline conditions appear in the lagoon system.
1889	A railway embankment is built.	Water balance is altered with the division of the lagoon system into what are basins I and II today. There is a concomitant alteration of the water quality along with changes in the plankton communities and benthos.
1937	Inauguration of tunnel connecting Manzanillo Bay with Cuyutlán Lagoon in basin II.	Altered water balance and water quality in basin II (it is speculated that the quality improved).
1959	Filling in the western part of basin I of Cuyutlán Lagoon and the western area of the rail depot.	Shrinkage of lagoon surface, causing alteration of the basins' bathymetry and substrate.
1978	CFE opens Ventanas Canal in basin I for the Manzanillo Thermal Power Complex.	Altered water balance in basin I; changes in water quality and in the plankton and nekton communities.
1980	The Ministry of Communications and Transportation begins construction on the embankment supporting the dredging pipe from the port across the width of basin II.	Negative influence on the water balance of the lagoon, interfering with the free flow of water.
1981	CFE builds a breakwater in basin I, leaving only a 20 m-wide connection with basin I. Installation of transmission towers crossing the width of basin II.	Negative alteration of lagoon water balance due to interference with water flow between basins.
1989	Opening of the Tepalcates Canal connecting basin II with the ocean.	Water balance alteration mainly in basins II and III; changes in water quality and in the plankton and nekton communities.
2000	Reopening of the Tepalcates Canal after it was silted up by longshore drift.	
2006	Tepalcates Canal dredged, reestablishing the ocean connection.	
2008	Dredging and widening of the Tepalcates Canal from 70 to 250 metres. Dredging of Cuyutlán Lagoon to create an access channel and basin for the Manzanillo Liquid Natural Gas Terminal.	

29 Amendment to EIS-LNG, note 17 *supra,* ch. IV, at 263–4; Mellink and Riojas López 2007, note 11 *supra,* at 131–42; Torres and Quintanilla-Montoya 2014, note 8 *supra,* at 37.

Figure A5-1: Structural modifications of Cuyutlán Lagoon



	Principal change-inducing events
3000 B.C.E.	1. Interruption of flows from the Armería River.
500-600 C.E.	2. Installation of salinas throughout the lagoon.
1870	3. Natural inlet between Cuyutlán Lagoon and Pacific Ocean starts to disappear.
1889	4. Construction of a railway embankment.
1959	5. Filling in the western part of basin I of Cuyutlán Lagoon.
1978	6. Opening of the Ventanas Canal in basin I.
1980	7. Construction of the dredging pipe embankment in basin II.
1989 and 2008	8. Opening of the Tepalcates Canal; widening from 70 to 250 metres.
2008	9. Dredging of basin II.
2008	10. Modification of the rail line in basin II.

Source: Image derived from information contained in the regional form of the EIS-LNG, ch. IV, and E. Mellink and M. Riojas López, "Modificaciones estructurales artificiales de la laguna de Cuyutlán, Colima, México," (see complete bibliographical references in notes 17 and 9, respectively), as well as in the document "III Vinculación con los instrumentos de planeación y ordenamientos jurídicos aplicables" (in Response to Infomex request no. 0001600024715, 17 February 2015).
Structural modifications shown in items 8 and 9 in the above table are related to the LNG Terminal Project.

1.2 Analysis of the Cuyutlán Lagoon basins

This section describes the main characteristics of each basin of Cuyutlán Lagoon as per the hydrodynamic studies conducted prior to the operation of the LNG Terminal project.

Generally speaking, the ecological characteristics and natural dynamics of Cuyutlán Lagoon exhibit severe alteration due to the activities of industry, agriculture, and human settlements on its banks and in the body of water itself. Each basin exhibits areas with different degrees of disturbance, as a function of their geomorphological conditions, water balance, and uses.[30]

A topobathymetric analysis shows that the mean depth of the lagoon is approximately 1 m. An area representing 60% of basins I and II has a depth less than 1 m, while elsewhere in these basins the depth is 1–2 m. Nearly the entirety of basin III is under 1 m deep, with a mean of 0.3 m. The mean depth of basin IV is on the order of 1.5 m. In the connection between basins I and II, the depth reaches 3 m; in the ravine between basins II and III, the depth can reach 3 m. A study produced by the CFE on 21 May 2008 showed that the surface area was 43.25 km^2 (4,325 ha), which is less than the figure obtained from other information sources consulted by the CEC Secretariat. Basin I, the smallest, has an area of 1.79 km^2; basin II covers an area of 15.4 km^2; basin III, the largest, measures 17.6 km^2, and basin IV measures 8.5 km^2.[31]

i. Characteristics of each basin

Basin I is a small section at the west end of the lagoon that is separated from the rest by an embankment built for the rail line running to the port of Manzanillo. This subsystem contains the Manzanillo Thermal Power Complex, which is connected to the ocean through the Ventanas Canal built in 1978 by the CFE to obtain water for the complex's cooling system. Subsequently, when it became necessary to supply more water to this cooling system, the intake channel was built. For this purpose, basin I was divided.[32]

Basin II comprises the area between basin I and a natural hilly constriction to the southeast; it is one of the two basins connected to the ocean by the Tepalcates Canal and harbors two large islands. It is in this basin that the LNG Terminal and the port facility are sited, since the widening of the canal made it possible for gas tankers en route to the LNG Terminal to enter. The EIS-LNG states that the north bank forms a narrow strip of mangroves from 1 to 50 metres wide; however, with the construction of the docking facilities, deforestation of this mangrove area was expected.[33]

Basin III of Cuyutlán Lagoon comprises the area between the hilly constriction separating it from basin II and a very shallow area to the southeast. It has the largest area of all the basins; according to a recent CFE study it has a length of 17.6 km, depths of up to 3 m, and no connection with the ocean.[34] The water circulation velocity is calculated at ≤0.10 m/s. This basin includes two small islands as well as many islets and hollows that are revealed when the water level descends. Basin III contains a salina because, like basin IV, it is less influenced by the tides; its anoxic areas and slow circulation make it a shallow, semi-isolated area, thus accelerating the evaporation process. The saline concentration is higher than in seawater (>50 psu), a situation that becomes even more pronounced during the dry season (February to June).[35]

The EIS-LNG review of the environmental conditions of the lagoon system and, more specifically, of basin III indicates that due mainly to sediment accretion during the rainy season, the surface area of the basin is continuing to shrink (2000–2006 data). This drying has accentuated the salinization of the soil, fostering the development of marsh communities and eroding the mangrove ecosystem. If the slow water circulation and silting of this basin continue, the marshland is likely to predominate while the mangroves will continue to disappear.[36]

30 Torres and Quintanilla-Montoya 2014, note 8 *supra,* at 29.
31 CFE, "Estudios para dar respuesta a las condicionantes emitidas por la DGIRA en el resolutivo de impacto ambiental para el proyecto de la Terminal de Gas Natural Licuado en Manzanillo, Colima," at 6.
32 Torres and Quintanilla-Montoya 2014, note 8 *supra*; Mellink and Riojas López 2007, note 11 *supra,* at 133; CFE-GEIC Study on Conditions 2010, note 21 *supra,* at 1–2.
33 EIS-LNG, note 17 *supra,* ch. IV, at 161; Mellink and Riojas López 2007, note 11 *supra,* at 133; Torres and Quintanilla-Montoya 2014, note 8 *supra,* at 34.34 CFE-GEIC Study on Conditions 2010, note 21 *supra*, at 6.
35 EIS-LNG, note 17 *supra,* ch. IV, at 82, 108, 118, 306, 326; Torres and Quintanilla-Montoya 2014, note 8 *supra,* at 39.
36 EIS-LNG, note 17 *supra,* ch. VII, at 8.

Basin IV, comprising the area between the hollows of basin III and the end of the lagoon, does not connect to the ocean, but joins the Palo Verde salt marsh, possibly one of the connections with the watershed and thus a source of fresh water and sediment. This basin has a mean depth of about 1.5 m and an area of some 8.5 km^2, making it the second smallest of the four basins that make up Cuyutlán Lagoon. The limited connectivity of this basin (due to the salina dam) is such that water circulation is not evident during the dry season. During the rainy season, runoff from the salt marsh can create a connection with basin III. As mentioned in the previous paragraph, salt harvesting is the activity that has most severely affected the biotic conditions of this basin and of basin III. In both basins, however, anthropic stress is minor, resulting in an abundance of resident and migratory bird species as well as protected species such as crocodiles. Basin IV, including the Palo Verde salt marsh, also exhibits a visually appealing landscape containing mangroves in greater abundance; it is, on the whole, in a better state of conservation.[37]

ii. Ecological conservation status of the basins

As a consequence of the changes and disturbances suffered by the basins of Cuyutlán Lagoon over time, the natural evolution of this coastal ecosystem has been radically altered, very probably precluding any possibility of its being restored to its original state. The disturbances to which each basin has been subjected are a function not only of local conditions or modifications but also of those occurring on a regional scale, primarily those related to the watersheds draining or formerly draining into each basin.[38]

Coastal lagoons such as Cuyutlán depend on a balance between flows of water, sediments, and organisms coming from both inland and the ocean. Any alteration of one or both connections gravely affects the natural dynamics, as is occurring in Cuyutlán Lagoon. Therefore, its current and future dynamics depend on the management objective adopted, and ultimately on direct human intervention in a long-term context. Even though its dynamic is now and will continue to be artificial, it is important to define short-, medium-, and long-term objectives to at least preserve what remains of its ecological complexity, for it is still providing various ecosystem services.[39]

As regards the ecological conservation status of the various lagoon basins, basins I and II are those exhibiting the highest level of direct anthropic disturbance due to industrial activities and human settlements. In addition, the intense seasonal impact related to tourism in Manzanillo directly affects basins I and II. On another note, despite the fact that fishing takes place throughout the lagoon, the landing sites of the fishing cooperatives are located on the banks of both basins.[40]

From the standpoint of water quality, the hydrodynamic of basins I and II is favorable. Residence times are short and there is little or no silting. In both cases, this favorable situation is due to the presence of canals connecting the two basins to the ocean (Ventanas Canal and Tepalcates Canal).[41] As regards basins III and IV, they exhibit less construction-driven landscape alteration, but their ecological condition is tightly linked to their ample spatial connectivity with the watershed and its effluents. This is in addition to the limited connectivity of these basins with basin II, where the Tepalcates Canal is located; the canal supplies water and influences the hydrodynamic of the lagoon.[42]

The most prominent activity in basins III and IV is small-scale salt harvesting (without machinery), which occupies a sizeable portion of these basins.[43] In addition to the salinas, the dams built to manage the water levels of the salinas influence the hydrodynamic of the lagoon.

This is especially true of the dam between basins III and IV.

Even though salt harvesting is seasonal (February to June), the dams influence the hydrodynamic and favor the extension of the marsh area to the detriment of the mangroves. The environmental heterogeneity of both basins favors the diversity of functions associated with the ecosystem services, although the need to implement local management of the various activities carried out therein is recognized.[44]

37 EIS-LNG, note 17 *supra,* ch. IV, at 204, 238, 302, 305, 326; Torres and Quintanilla-Montoya 2014, note 8 *supra,* at 29, 39–40; CFE-GEIC Study on Conditions 2010, note 21 *supra,* at 6.
38 EIS-LNG, note 17 *supra*.
39 *Ibid.*
40 *Ibid.*
41 CFE-GEIC Hydrological Study 2010, note 13 *supra.*
42 EIS-LNG, note 17 *supra.*
43 EIS-LNG, note 17 *supra,* ch. IV; Torres and Quintanilla-Montoya 2014, note 8 *supra,* at 39.
44 EIS-LNG, note 17 *supra*.

Concerning basin III, ecological restoration measures are planned with a view to stabilizing the condition of the mangroves and the water column, both of which have a direct positive effect on biodiversity and biological productivity. While basin IV has been disturbed by highway and rail infrastructure, it exhibits the best overall ecological conditions in Cuyutlán Lagoon. The section corresponding to the Palo Verde salt marsh is notable for being one of the very few points of connectivity with the watershed.[45] According to an expert consulted by the Secretariat, in basin IV, measures to maintain the connectivity with the Palo Verde salt marsh are probably a priority.[46] In contrast to the Tepalcates Cana, the Palo Verde salt marsh maintains natural connectivity, favoring the system's heterogeneity. In addition, it is probable that the Palo Verde salt marsh should be extended towards basin III to rectify the hypersalinity of the latter. In this regard, studies of coastal dynamics are envisaged to support any recommendation to open an arm of the lagoon through basin III to the ocean, which would in principle increase water flow.[47]

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Lagoons depend on a balance created by transport of water, sediment, and organisms from inland and from the ocean. The current and future dynamics depend on the management objectives for the lagoon and on long- term direct human intervention.

Irrespective of the management objective(s) for Cuyutlán Lagoon, it has been noted that a diagnostic study and monitoring programs comparable to those of other bodies of water are needed for this lagoon.[48]

In addition, given the acknowledged social, economic, and environmental importance of this ecosystem, is the absence of systematic studies yielding syntheses for decision-makers. The few existing studies have been done to meet a particular need or standard or, in the best case, to answer a question of scientific interest.

Cuyutlán Lagoon (basins III and IV) is designated as a Wetland of International Importance. On 2 February 201, it was placed on the List of Wetlands of International Importance as site number 1985 of the Convention on Wetlands of International Importance (Ramsar Convention).[49]

The focus recommended by the independent consultants retained by the CEC Secretariat for the diagnostic study and monitoring of Cuyutlán Lagoon is ecosystemic and long-term, similar to the one applied to the coastal ecosystems of the Gulf of Mexico within the UNESCO Large Marine Ecosystems approach, with financing from the Global Environment Fund (GEF) and coordinated by Semarnat in Mexico and by the National Oceanic and Atmospheric Administration (NOAA) in the United States.[50] This focus provides information to influence public policy and allow for a proper decision-making process aimed at mitigating the degradation of the ecosystems and conducing to their ecological restoration, with the goal of restoring their resilience in some measure.

2. Water quality in Cuyutlán Lagoon

Few systematic studies have been done to guide decision-making on Cuyutlán, despite the social, economic, and environmental importance of this ecosystem.

This section presents information gathered by the CEC Secretariat in relation to the hydrodynamic study submitted by the CFE to the DGIRA to comply with the conditions of the AIA-LNG, and particularly condition 3. An analysis of the water quality results for Cuyutlán Lagoon is also presented.

45 EIS-LNG, note 17 supra, chapters IV and V; Torres and Quintanilla-Montoya 2014, note 8 supra, at 39.
46 Herrera and Mariño 2015, note 10 *supra*.
47 Such studies would identify the risk of its getting out of control and reaching magnitudes such as those observed in Marismas Nacionales, Nayarit.
48 Herrera and Mariño 2015, note 10 *supra*.
49 Order promulgating the Convention on Wetlands of International Importance, especially as Waterfowl Habitat, published in the DOF on 29 August 1986. The designation of Cuyutlán Lagoon basins III and IV can be found at <http://goo.gl/Xr28wf> (viewed 19 October 2015).
50 V. García Ríos, L. Alpuche Gaul, J. Herrera, J. Montero Muñoz, S. Morales Ojeda, D. Pech, M.F. Cepeda González, O. Zapata Pérez, and G. Gold Bouchot (2013), "Towards a coastal condition assessment and monitoring of the Gulf of Mexico Large Marine Ecosystem (GoM LME): Terminos Lagoon pilot site," Environmental Development, vol. 7, at 72–9.

Figure A5-2: Changes in the Tepalcates Canal between 2006 and 2012

This photo clearly shows net transport of sand toward the east, with accretion of sand behind the west breakwater.

This photo clearly shows net transport of sand toward the east, with accretion of sand behind the west breakwater.

Source: Google Earth

The image from 13 June 2011shows progress on the dredging of the canal, while the image from 30 March 2012 shows the canal after dredging and the Manzanillo LNG project.

2.1 Context of the hydrodynamic study

Figure A5-2 shows a sequence of photos of the Tepalcates Canal before, during, and after construction of the LNG Terminal. The image from 20 February 2006, taken before construction, clearly shows net transport of sand to the east, with accretion of sand against the breakwater on the west side (left side of photo), as well as marked erosion at the east breakwater and a considerably silted channel, impeding water interchange between the lagoon and the ocean. The image from 10 June 2009 shows the canal dredged and without sand, as well as progress on construction of the project. The construction of the two breakwaters is also visible. These new breakwaters, with an opening of approximately 500 m, served as a guide to the widening and dredging of the Tepalcates Canal. During the construction of the project, the CFE requested approval of various modifications from various authorities, such as protection of the banks of the Tepalcates Canal with rock material, as well protection of the starting point of the breakwaters so as to reinforce them with prefabricated material and improve the stability and preservation of these banks. This would serve to prevent impact on the land adjacent to the canal. The DGIRA approved these changes to the project with its decision of 9 September 2010.[51] The image from 13 June 2011 shows progress on the dredging of the Tepalcates Canal; that from 30 March 2012 shows the canal after dredging and the completed LNG Terminal project.

2.2 Results of water quality study of the lagoon

The water quality results are shown with graphs for each parameter in Figure A5-3. The trophic state of Cuyutlán Lagoon is shown in Figure A5-4.

Temperature. The mean temperature values in basins I and II are similar to those of the Pacific coastal waters due to the Ventanas and Tepalcates canals. The highest temperatures were recorded in basins III and IV, where the influence of currents is less pronounced. The highest temperature was recorded in basin III (30.7 °C), the lowest in basin I (28.35 °C), both measurements taken in 2004.[52]

Salinity. The lowest salinity values were recorded in basins I, II, and III, and they were lowest in the period from 1990 to 2000; the highest value (49 psu) was recorded in basin IV in the period 2001–2005, the lowest value (36.5 psu) in basin II during the same period. The higher values are due to marine water influx into basins III and IV, which are largely shallow, facilitating evaporation.

Dissolved oxygen. The highest dissolved oxygen value (7.8 mg/m^3) was recorded in the period 1990–2000 in basin II, while the lowest value (4.74 mg/m^3) was recorded in 2001–2005 in basin IV. These results indicate that only basin IV exhibits concentrations associated with a body of water of this depth, while the concentrations in basins I, II, and III indicate a significant marine influence on the four basins of Cuyutlán Lagoon.

Hydrogen potential (pH). The highest pH value (8.6) occurred in basin III during the period 2001–2005, the lowest value (7.9) in basin IV in 1990–2000. pH is a measure of the acidity or alkalinity of a solution. Values above 7 indicate that the water in Cuyutlán Lagoon is basic.

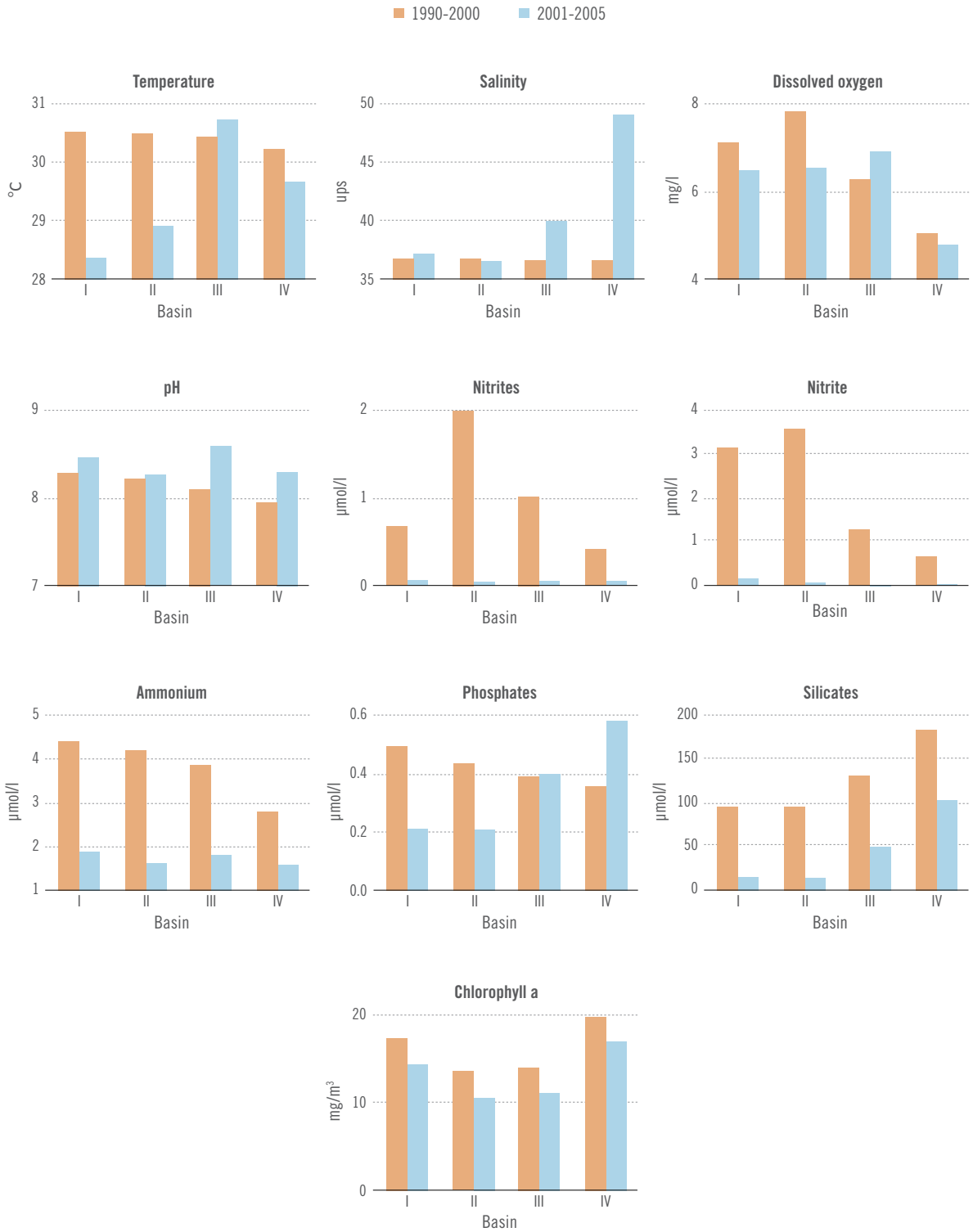
Nitrites. In the 1990–2000 period, basin II recorded the highest concentration of nitrites, with 1.98 µmol/l, while the lowest value (0.031 µmol/l) occurred in 2001–2005 (see Figure A5-3). Concentrations of this nutrient are associated with seawater interchange and low nutrient availability in the area.

Nitrates. The lowest nitrate concentration was recorded in basin III, the highest in basin II, with values of 0.025 and 3.54 µmol/l, in the periods 1990–2000 and 2001–2005, respectively. Concentrations of this nutrient declined significantly during this time, indicating "good condition."

Ammonium. The highest value (4.39 µmol/l) occurred in basin I, the lowest (1.58 µmol/l) in basin IV. This parameter decreased significantly from one period to the next. The low concentrations in the latter period are a result of interchange between the lagoon and the ocean.

51 DGIRA, file no. S.G.P.A./DGIRA/DG/6568/10, 9 September 2010.
52 EIS-LNG, note 17 *supra*, ch. IV, at 114.

Figure A5-3: Principal water quality parameters for Cuyutlán Lagoon



Phosphates. As regards soluble reactive phosphorus (phosphate) concentrations, the lowest values (0.21 µmol/l) occurred in basins I and II. The highest concentration (0.58 µmol/l) was observed in 2001–2005 in basin IV. Fluctuations in phosphate concentrations are related to biological and geochemical processes. This variable showed an increase in basins III and IV from one period to the next.

Silicates. In the 2001–2005 period, the lowest value for silicates (11.29 µmol/l) was recorded in basin II, the highest (180.27 µmol/l) in basin IV. Although high concentrations were observed from 1990 to 2000, they decreased considerably in 2001–2005, with values under 100 µmol/l across the board.

Chlorophyll a. The highest value (19.73 mg/m^3) was observed in basin IV in 1990–2000, the lowest values in basin II (10.49 mg/m^3) in 2001–2005. Chlorophyll a is a variable widely used as an indicator of phytoplankton biomass, this being one of the primary symptoms of eutrophication. The high concentrations of chlorophyll a in Cuyutlán Lagoon indicate that its basins are becoming eutrophic, a relatively normal condition for a coastal lagoon, although these values are high with respect to the average for other Pacific coast lagoons.[53]

Trophic status. The trophic status of the basins of Cuyutlán Lagoon is as indicated in Figure A5-4: basins I and II changed from dystrophic in the period 1990–2000 to oligotrophic in the period 2001–2005; basin III was eutrophic in the first period and changed to oligotrophic in the second, and basin IV went from dystrophic (1990–2000) to mesotrophic (2001–2005). These improvements in trophic status are related to the reopening of the Tepalcates Canal in the year 2000, although they predate the widening effected by the LNG Terminal project in 2008.

Figure A5-4: Trophic status of the basins of Cuyutlán Lagoon, 1990–2000 and 2001–2005

Source: Google Earth and Herrera and Mariño 2015.

53 F. Contreras Espinoza (1985), *Las lagunas costeras mexicanas*, 2nd ed. (Mexico City: Centro de Ecodesarrollo).

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