STANDARD INSURANCE, PHILIPPINES UTILIZES GIS TECHNOLOGY IN NATURAL HAZARD ASSESSMENT

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Abstract

The insurance industry is continuously improving risk management by installing appropriate systems and tools for the hazard assessment of perils such as earthquake, typhoon and flood for insurance cover.

In the Philippines, considered as one of the most disaster-prone countries in the world, extensive assessment of the natural disasters becomes essential to risk managers.

Through the Geographic Information System (GIS) and the Global Positioning System (GPS), risk assessment techniques are developed to determine the degree of geohazards involved in each risk (property to be insured).

Standard Insurance Company, Inc. has its own study of local natural hazards, which GIS graphically represents in maps. The company's GIS is utilized to provide risk accumulation analysis. Through this, the company is able to acquire catastrophe cover from international reinsurance companies at a high coverage against total accumulation.

Introduction

Standard Insurance Co., Inc. is engaged in the non-life insurance business. One of its major portfolios is property insurance. Coverage against natural perils like earthquake, typhoon and flood are normally included in insuring properties.

Generally, properties and infrastructures in the Philippine market are exposed to various natural and geologic hazards.

With the Philippines lying along the so-called "Ring of Fire", this geographically makes the country vulnerable to earthquake and volcanic hazards.

On the average, 20 tropical cyclones cross the Philippine area of responsibility every year.

Floods and landslides are normal occurrences due to heavy monsoon rains and rains brought about by tropical cyclones in the region.

Metro Manila is one of the most densely populated cities in the Philippines where the center of business, trade and commerce is located. Majority of the risk

locations included in Standard Insurance Co., Inc.'s property portfolio is in Metro Manila, where the city capital of the Philippines is located and which consists of 13 cities and 4 municipalities. It is exposed to earthquakes by nearby faults and trenches. One of these faults, known as the Valley Fault System (VFS), traverses Metro Manila. Numerous tropical cyclones (including typhoons) frequent the region and results to flooding due mainly to urbanization and high population density.

As insurers cover losses due to natural hazards, the insurance underwriters need to be fully aware of the presence of the risks due to natural hazards and their effects. Natural hazard assessment tools are then utilized to assist the underwriters in determining the acceptability of properties being insured against the natural hazards.

Incorporating the inputs of the natural hazard assessment into the total risk perspective enables the company to improve risk management through better underwriting and risk assessment.

Natural Hazard and Risk Assessment

In underwriting risk against natural perils, natural hazard information and risk assessment plays an important role. With the known exposure to the different natural hazards, underwriters, risk engineers and risk engineering analysts are made aware of the important areas or aspects of a particular property which will need closer attention with respect to risk assessment. While hazards may be present in a particular risk exposure, the need for mitigation and engineering measures against those hazards are likewise taken into consideration in order to determine the extent of the exposure and their probability of occurrence.

Risk Management

While insurance companies allow themselves to accept sizeable amount of risks and the number of individual risks for which it wishes to underwrite and accumulate, insurers control its financial exposure through a risk management technique called risk transfer. The concept of transferring risk, i.e., one party transferring the financial effects of his loss to another party, is vital to an insurer to enable him to reduce to acceptable levels of probability the severe claim or accumulation of claims that will ruin or threaten the company's financial stability.

Accumulation control, portfolio analysis and catastrophe analysis are done as part of the risk management techniques. Through these analyses, underwriters and risk managers will be able to apply the concepts of risk transfer or reinsurance, cession limits, liability limits, etc.

Catastrophe Risk Monitoring System (CRMS)

Cognizant of the need for a natural hazard and risk assessment tool for better underwriting and risk engineering, and to provide a system that can generate and manage risk information for the acquisition of reinsurance facilities and Catastrophe (CAT) cover, the company, through the Risk Engineering and Risk Management departments, developed the Catastrophe Risk Monitoring System (CRMS).

The system, currently in version 1.0, is in the first phase of development covering Metro Manila. The natural hazard information included in the system is initially limited to earthquake, typhoon, flood, landslide, and volcanic eruption.

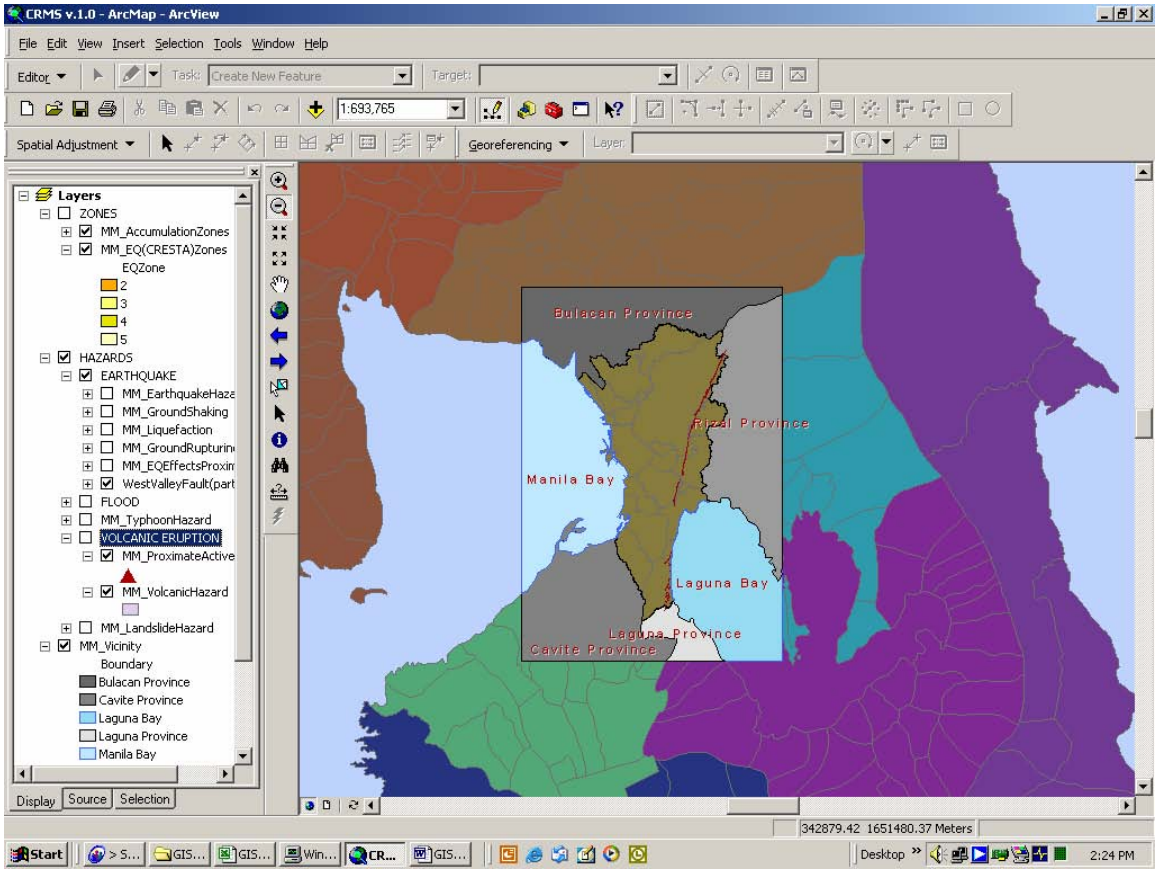


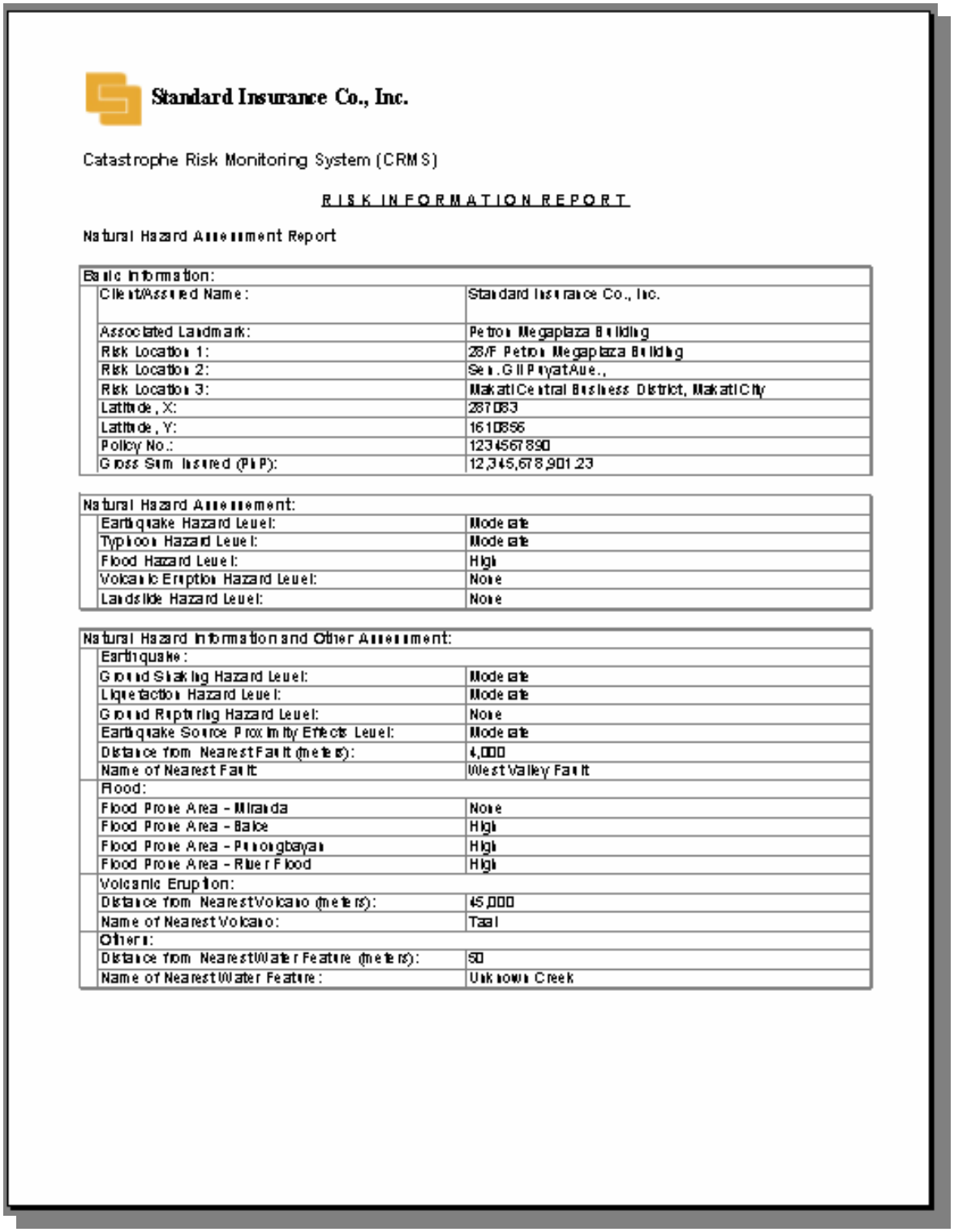
***Figure 1. Metro Manila Vicinity Map.**. This map shows the surrounding land and water features of Metro Manila. Metro Manila area is the scope of phase 1 of CRMS v.1.0.*

CRMS in Natural Hazard and Risk Assessment

Utilizing the system for natural hazard and risk assessment enables us to plot the risk being insured over various natural and geologic hazard maps. Subsequently, the system generates natural hazard assessment reports which include hazards brought about by earthquake, typhoon, flood, volcanic eruption and landslide. The hazard susceptibility rating is analyzed and rated according to grading levels of high, moderate, low and none.

The rating system provides risk engineering analysts and underwriters a better understanding of the degree of exposure involved and other factors that influence the exposure levels present in a particular property being assessed against the natural hazards.

However, not all risks located in “high” hazard areas should be treated as “high risk” or unacceptable risk without considering the engineering measures implemented and the physical conditions of the property. Apart from the natural hazard information in the database, CRMS also includes in its records risk engineering information related to the physical characteristics of the property such as building height, age, type of construction, etc. Engineering measures such as seismic design, type of structural frame, etc. also form part of the overall risk assessment prior to acceptance or declination of the risk.



Standard Insurance Co., Inc.

Catastrophe Risk Monitoring System (CRMS)

RISK INFORMATION REPORT

Natural Hazard Assessment Report

Basic Information:	
Client/Assured Name:	Standard Insurance Co., Inc.
Associated Landmark:	Petron Megaplaza Building
Risk Location 1:	28/F Petron Megaplaza Building
Risk Location 2:	Sen. Gil Puyat Ave.,
Risk Location 3:	Makati Central Business District, Makati City
Latitude, X:	287083
Latitude, Y:	1610856
Policy No.:	1234567890
Gross Sum Insured (PHP):	12,345,678,901.23

Natural Hazard Assessment:	
Earthquake Hazard Level:	Moderate
Typhoon Hazard Level:	Moderate
Flood Hazard Level:	High
Volcanic Eruption Hazard Level:	None
Landslide Hazard Level:	None

Natural Hazard Information and Other Assessment:	
Earthquake:	
Ground Shaking Hazard Level:	Moderate
Liquefaction Hazard Level:	Moderate
Ground Rupturing Hazard Level:	None
Earthquake Source Proximity Effects Level:	Moderate
Distance from Nearest Fault (meters):	4,000
Name of Nearest Fault:	West Valley Fault
Flood:	
Flood Prone Area - Miranda	None
Flood Prone Area - Balite	High
Flood Prone Area - Pinanggayan	High
Flood Prone Area - River Flood	High
Volcanic Eruption:	
Distance from Nearest Volcano (meters):	45,000
Name of Nearest Volcano:	Taal
Others:	
Distance from Nearest Water Feature (meters):	50
Name of Nearest Water Feature:	Unknown Creek

Figure 2. Risk Information Report – Natural Hazard Assessment Report. *This report shows the natural hazard assessment of a risk or property being insured. The risk is assessed from earthquake, typhoon, flood, volcanic eruption and landslide hazards.*

Standard Insurance Co., Inc.

Catastrophe Risk Monitoring System (CRMS)

RISK INFORMATION REPORT

Risk Engineering Information Report

Risk Engineering Information:		
	Plot Information:	
	Final Reading (Latitude, X):	287083
	Final Reading (Longitude, Y):	1610856
	Prelim Reading (GPS Latitude, X):	287083
	Prelim Reading (GPS Longitude, Y):	1610856
	Prelim Reading (Provided Latitude, X):	
	Prelim Reading (Provided Longitude, Y):	
	Risk Policy Information:	
	Risk Type:	General
	Occupancy:	Office
	Risk Status:	Renewal
	Gross Sum Insured (PhP):	12,345,678,901.23
	Client/Assured Name:	Standard Insurance Co., Inc.
	Risk Location Information:	
	Building Name:	Petron Megaplaza Building
	Building /Property No.:	#358
	Unit or Room No./ Floor No.	28 F
	Street:	Sen. Gil Puyat Ave.
	Corner Street:	N/A
	Compound/Subdivision:	Makati CBD
	Barangay/Area:	Bel-Air
	City/Municipality:	Makati
	Province:	NCR
	Building/Property/Site Physical Information:	
	No. of Storey:	44
	No. of Basement:	3
	Estimated Year Built:	1996
	Estimated Building Height (meters):	139
	Estimated Floor Area (square meters):	120,000
	Building Shape (Top View):	Square
	Type of Construction:	A
	Type of Roofing:	Roof Deck Slab
	Type of Structural Frame:	Reinforced Concrete
	Seismic Design:	Yes
	Structural Integrity:	Yes
	Structural Integrity Certification Date:	2-Feb-05
	Type of Foundation:	Mat
	Type of Subsoil:	Hard - Tuff
	Risk Plotting Process Information:	
	Assigned RE:	Leouis de Ramos
	Request Source:	RMD1
	Agent Name:	HOB
	Nature of REA:	Site
	Date of Visit:	25-Mar-05
	Remarks	Interview Info: Seismic Design, Type of Foundation,etc.
	Date of Remarks:	2-May-05

Figure 3. Risk Information Report – Risk Engineering Information. *This report contains the risk engineering information which helps underwriters realize the extent of the risk against natural hazards.*

CRMS in Risk Management

CRMS provides risk managers information about the current accumulation of policies in force in terms of gross sum insured. Accumulation zones in Metro Manila are subjected to accumulation limits. These limits prompt risk managers not to accept any risk with gross sum insured exceeding the maximum limits imposed.

Risk accumulation information generated by the system is always "current" and is constantly being updated, thereby allowing the utilization of such information in formulating retention policies, reinsurance facilities, cession limits, liability limits, and others.

Catastrophe analysis can also be made through the CRMS using the Catastrophe Risk Evaluating and Standardizing Target Accumulations (CRESTA) Zones. Metro Manila comprises of 4 out of the 9 CRESTA Zones for the entire Philippines. These zones are 2 (Makati City area), 3 (Manila Bay Reclamation area), 4 (Sta. Cruz/Binondo area) and 5 (areas within Metro Manila but outside zones 2, 3 and 4). Most insurance and reinsurance companies use this zone method to analyze the catastrophe exposure for CAT cover.

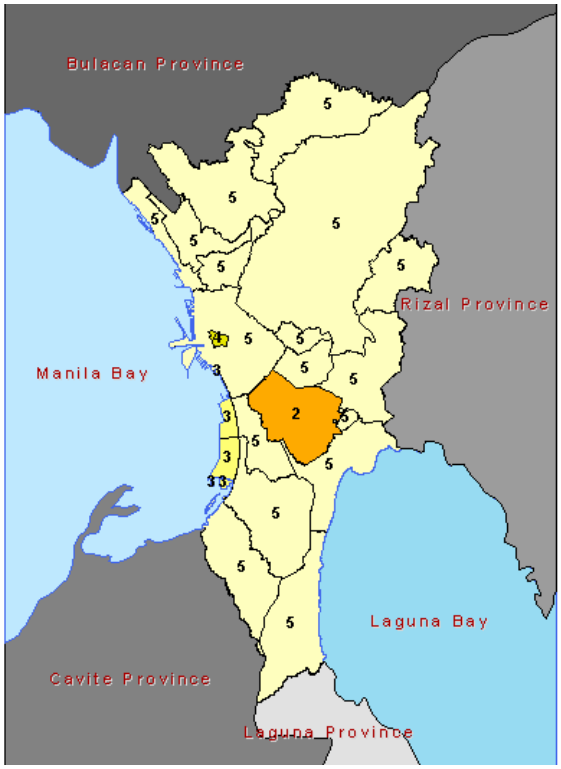


Figure 4. CRESTA Zones for Metro Manila. *This map shows the CRESTA Zones for Metro Manila. These zones are 2 (Makati City area), 3 (Manila Bay Reclamation area), 4 (Sta. Cruz/Binondo Area) and 5 (area outside Zone 2, 3, 4 and 5). (Note: These zones are derived from Catastrophe Risk Evaluating and Standardizing Target Accumulations)*

CRMS Functions and Features

CRMS version 1.0 has the functions and features that will benefit an insurer. Some of these functions are 1) Hazard Indicator, 2) Tempo/Active Risk Plotting, 3) Risk Identifier, 4) Single Risk Exposure, 5) Re-Plot Risk, 6) Accumulation Limit and 7) Automatic Straight-line Distance Measure.

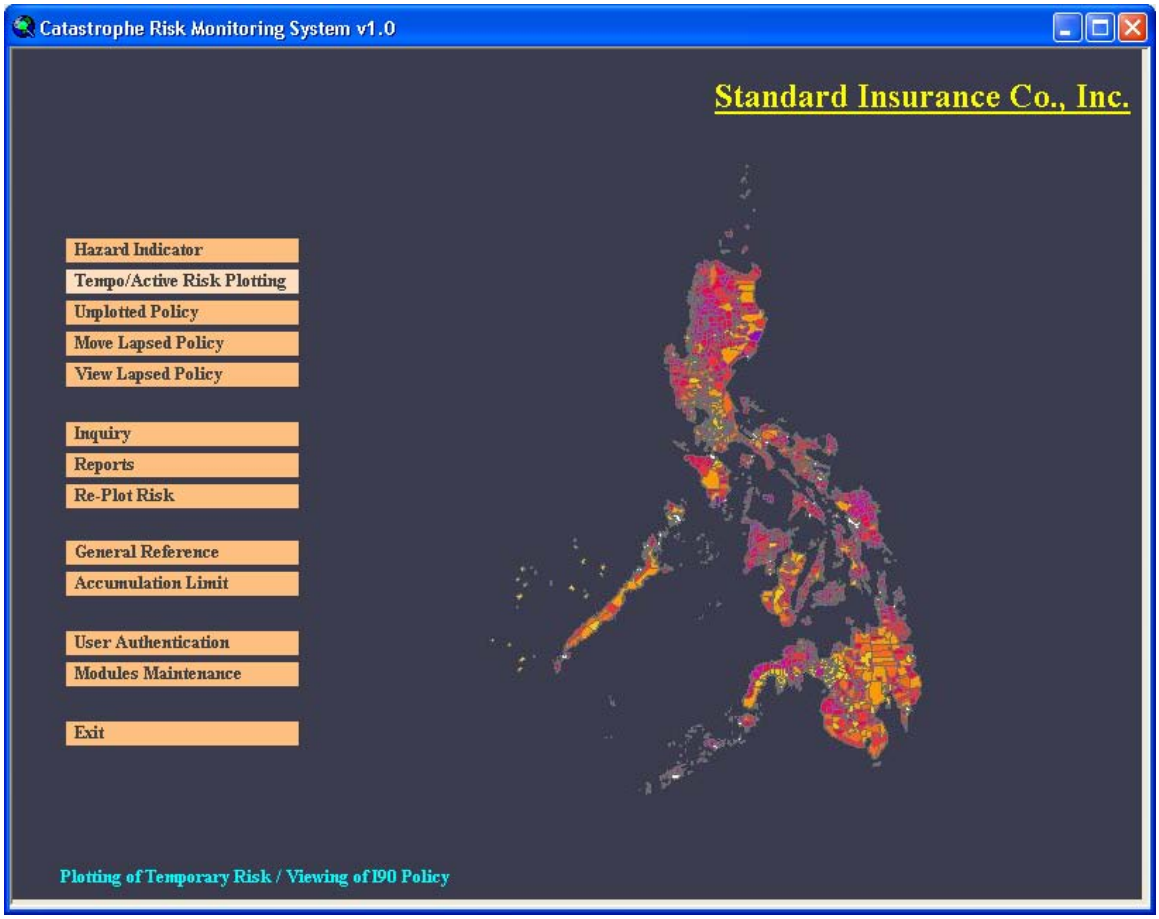


Figure 5. Catastrophe Risk Monitoring System (CRMS) Main Menu. *This window shows the main menu of CRMS which contains some of the functions and features that will benefit the local insurance companies.*

Hazard Indicator

One of the most vital functions of the CRMS is the Hazard Indicator. This instantly provides information on the degree of exposure (high, moderate, low and none) of a specified point location from the natural hazards. This allows other users of the CRMS outside the exclusive security premises of underwriters, risk engineers and risk engineering analysts, to be informed of their local exposure from the different natural hazards.

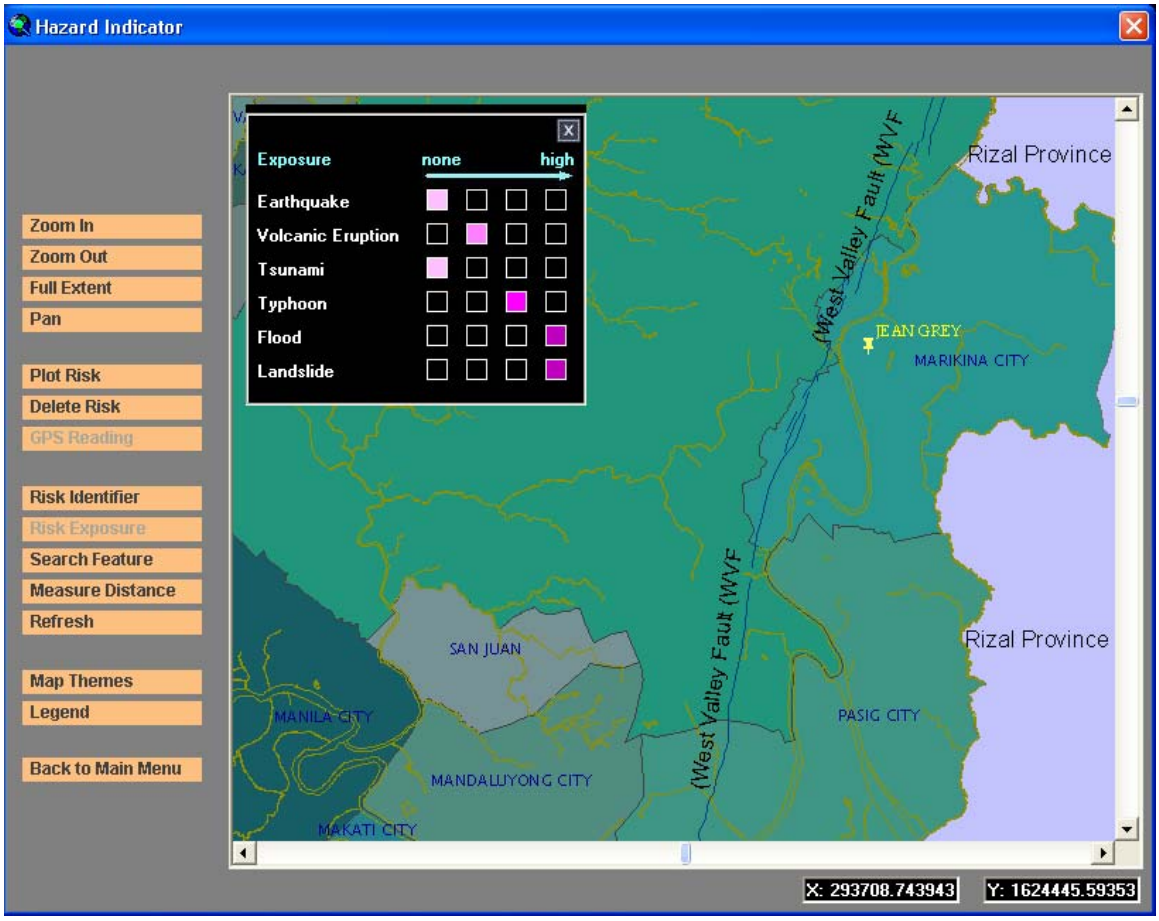


Figure 6. CRMS – Hazard Indicator. *This window lists all the natural hazards and their equivalent hazard levels. This information gives instant overview of the hazards involved in a particular point location or property.*

Tempo/Active Risk Plotting

This function shows the temporary plotting of risk/s being inspected or under quotation and also allows the viewing of active risk plots.

This is where CRMS now facilitates risk management and risk engineering by generating underwriting and risk engineering data information, respectively.

Plotting of the risk is very crucial since it provides a geographical representation of the risk being assessed and will be a vital tool in performing accumulation control, risk exposure identification and analysis.

Plotting can be done using the digital map or through recorded GPS readings of a particular risk. Some of the risks to be plotted exist in the landmarks layer of a map and may not need GPS readings from the actual site location. However, this module also allows the plotting of the risk directly into the map utilizing the GPS readings.

Technically, the final plot of the risk is evaluated and determined through the use of a GPS reading (if any), or from the existing landmarks identified or through the help of a detailed road network map which finally can be used to accurately locate the risks.

Initially, these plots are stored in the Tempo Risk Plot. It will be transferred to the Active Risk Plot after making a link to an appropriate risk data, coming from the Unplotted Policies. The risk data generated from the Active Risk Plot are the vital records that will be used in performing accumulation control and other assessment analysis requirements.

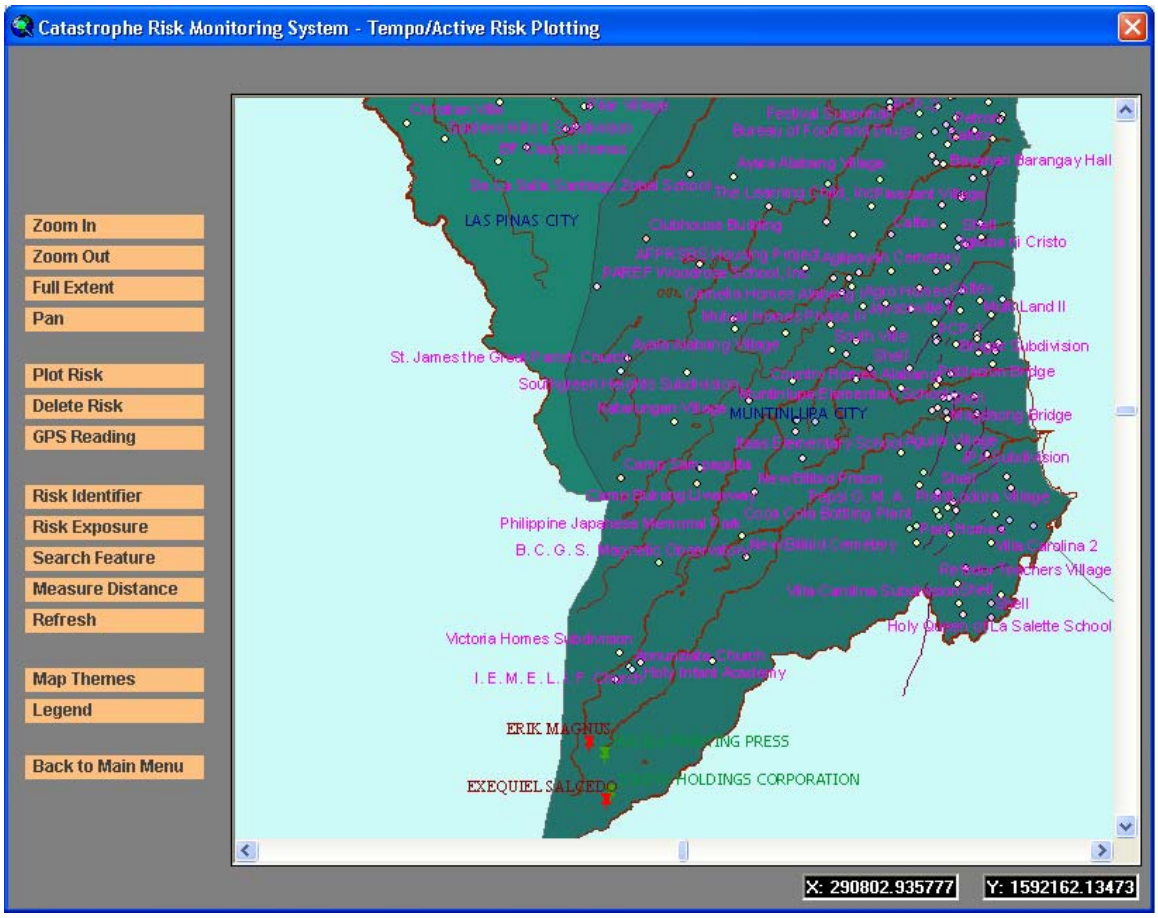


Figure 7. CRMS – Tempo/Active Risk Plotting. *This window shows the risks listed in "Tempo Risk" (maroon label and symbol), "Active Risk" (green label and symbol) and existing landmarks (pink label) plotted over the map. (Note: Risks being insured are confidential, thus all risk names are dummies.)*

Risk Identifier

This function provides almost all of the information needed by the risk engineering analysts, underwriters and risk managers for a particular risk. The Information Group shows a dropdown list of different information needed for hazard and risk assessment. This information includes all the map layers in the CRMS. Some of these are Earthquake Hazard, Underwriting Information, and many more. CRMS can generate and print reports from these information groups.

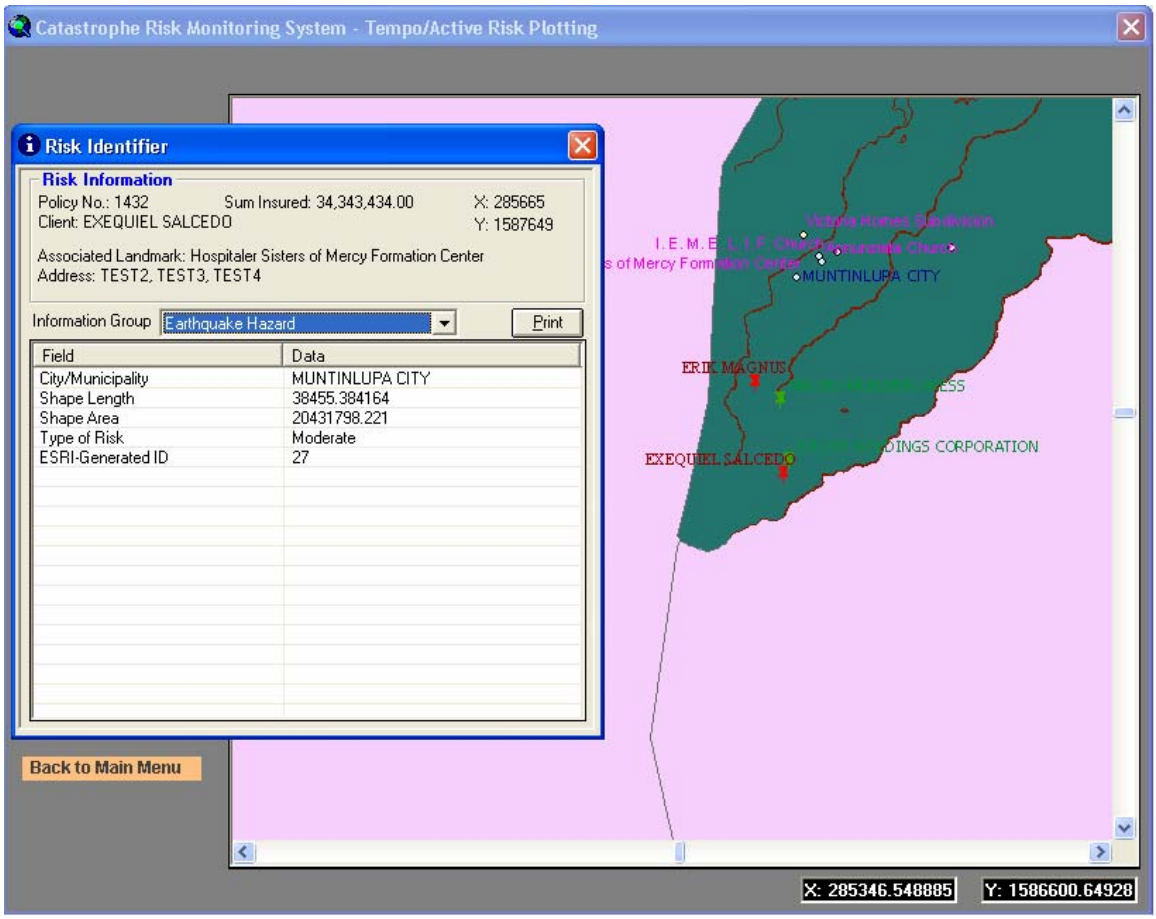


Figure 8. CRMS – Tempo/Active Risk Plotting – Risk Identifier. *This window shows the risks listed in "Tempo Risk" (maroon label) and "Active Risk" (green label) plotted over the map. . (Note: Risks being insured are confidential, thus all risk names are dummies.)*

Single Risk Exposure

This function of the CRMS allows the identification of risks (active or policy in force and tempo) which are within the same associated landmark. This association of different policies within the same landmark shows the accumulation of individual risks into single risk area or exposure. This function helps underwriters identify which policies are grouped into a single risk area and shows the total accumulation of the policies in terms of the total amount of insurance. Underwriters can now perform an assessment analysis which can be helpful in determining the risk exposure level/s.

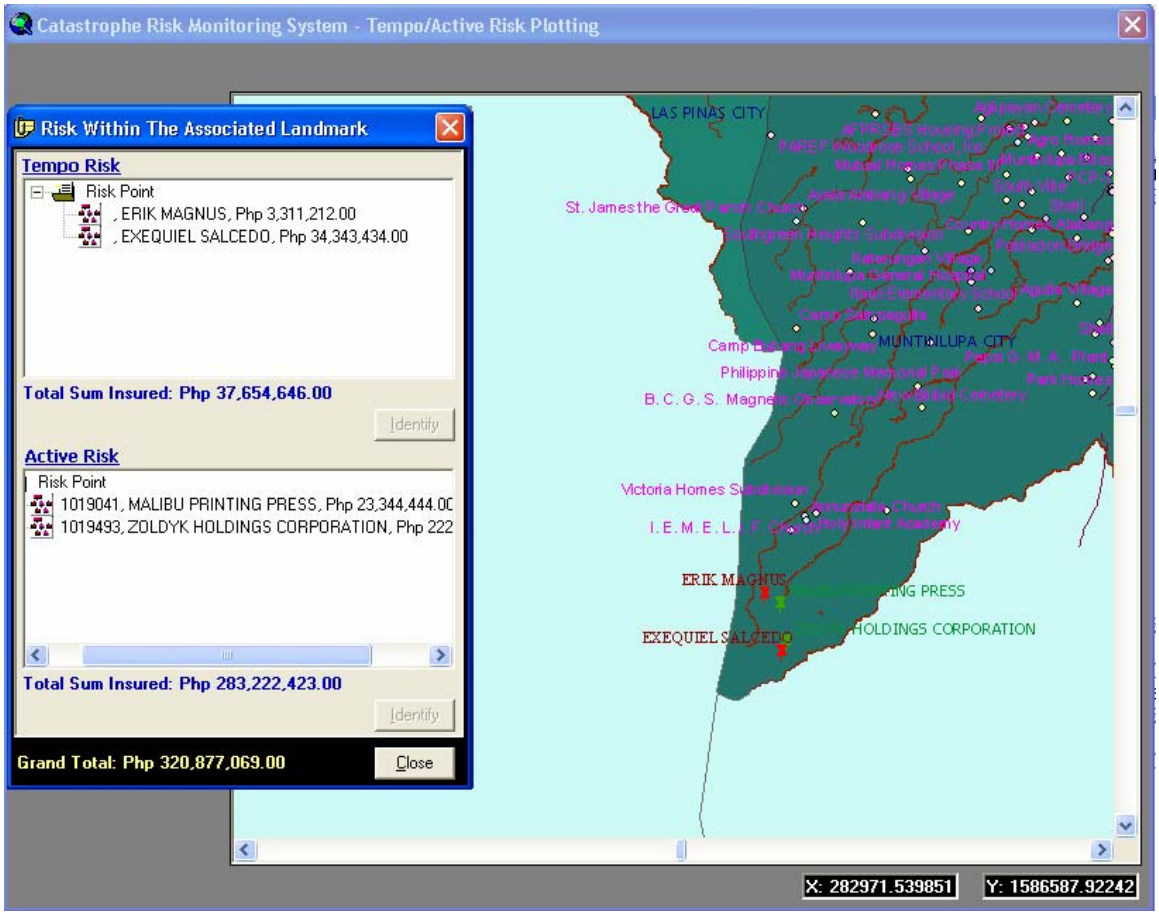


Figure 9. CRMS – Tempo/Active Risk Plotting – Single Risk Exposure. *This window shows the risks (including both Active and Tempo Risks) within the associated landmark which is considered "single risk". (Note: Risks being insured are confidential, thus all risk names are dummies.)*

Re-Plot Risk

In this function, existing plotted risks are re-plotted to generate an updated report (with respect to the natural hazards) whenever there is a change, revision or update of the digital hazard maps. Thus, the current information at hand are instantly updated which will enable up-to-date and accurate natural hazard assessment and accumulation analysis.

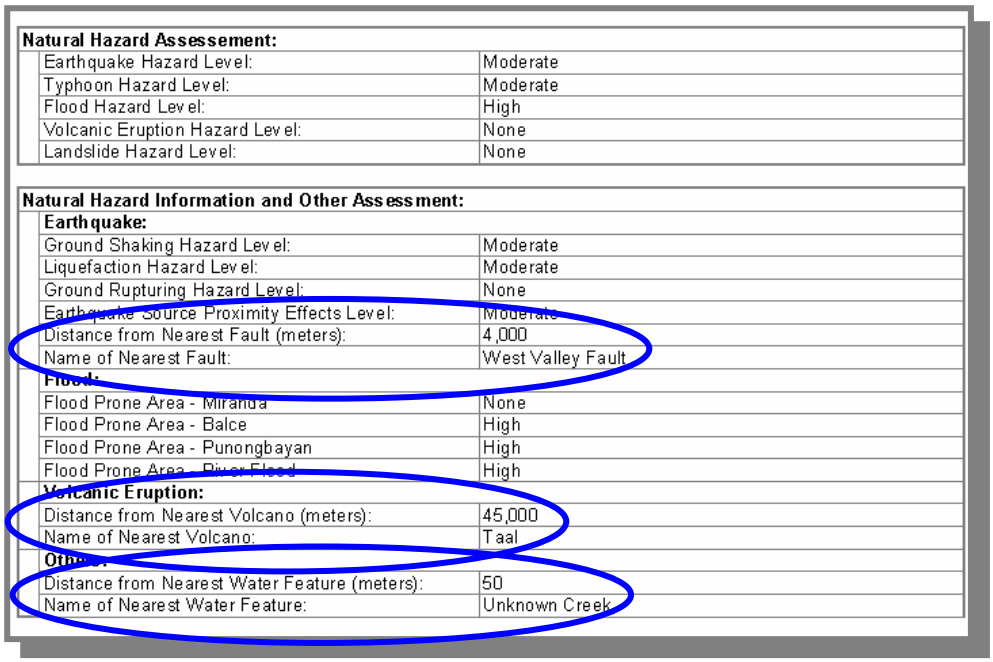
Accumulation Limit

This module is used to input the accumulation amount limit required by the risk managers for the accumulation zones and CRESTA zones.

Other Feature

Automatic Straight-line Distance Measure

Another great feature of the CRMS is the determination of the straight-line distance of a property being plotted to the nearest fault, volcano and water features (i.e., river, lake, sea). It is done automatically (without the need for manual measurement) after the risk is plotted. The system installed a measuring tool similar to ArcMap which facilitates distance measurement.



Natural Hazard Assessement:	
Earthquake Hazard Level:	Moderate
Typhoon Hazard Level:	Moderate
Flood Hazard Level:	High
Volcanic Eruption Hazard Level:	None
Landslide Hazard Level:	None

Natural Hazard Information and Other Assessment:	
Earthquake:	
Ground Shaking Hazard Level:	Moderate
Liquefaction Hazard Level:	Moderate
Ground Rupturing Hazard Level:	None
Earthquake Source Proximity Effects Level:	Moderate
Distance from Nearest Fault (meters):	4,000
Name of Nearest Fault:	West Valley Fault
Flood:	
Flood Prone Area - Miranda	None
Flood Prone Area - Balce	High
Flood Prone Area - Punongbayan	High
Flood Prone Area - River Flood	High
Volcanic Eruption:	
Distance from Nearest Volcano (meters):	45,000
Name of Nearest Volcano:	Taal
Other:	
Distance from Nearest Water Feature (meters):	50
Name of Nearest Water Feature:	Unknown Creek

Figure 10. CRMS - Automatic Straight-line Distance Measure. *This report shows the straight-line distance of a risk form the nearest fault, water feature, volcano, and their corresponding name.*

CRMS Process Flow in Risk Management and Underwriting

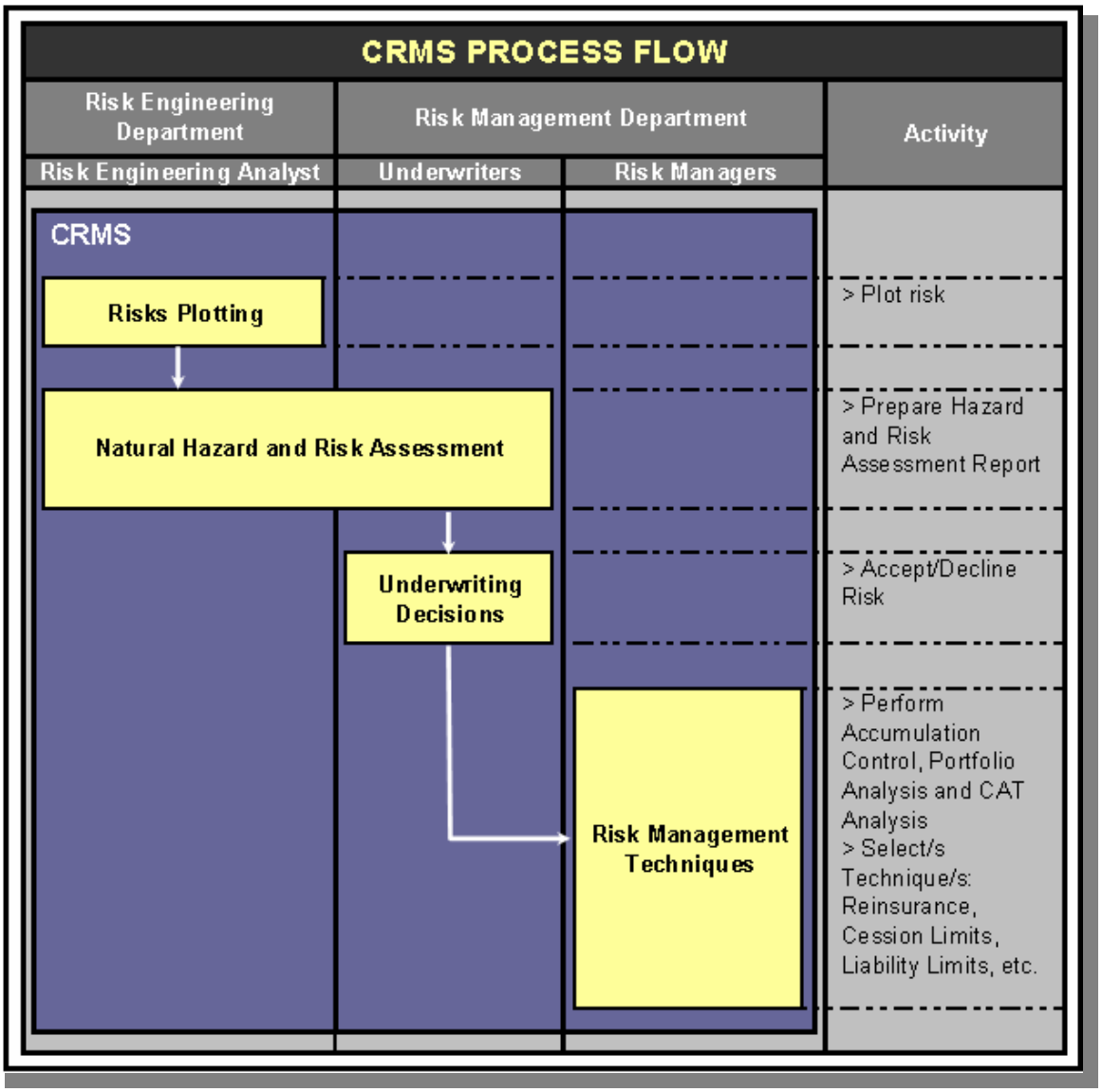


Figure 11. CRMS Process Flow in risk management and underwriting.

Tools Used in CRMS

The system was developed using Visual Basic 6.0 and ArcView 9.0. Map data is stored in the shapefiles. Other information is stored in the Sybase Adaptive Server Anywhere database. Policy data is retrieved from the Insure/90 (I/90) system database. The I/90 system is based on the AS/400 system and uses DB/400.

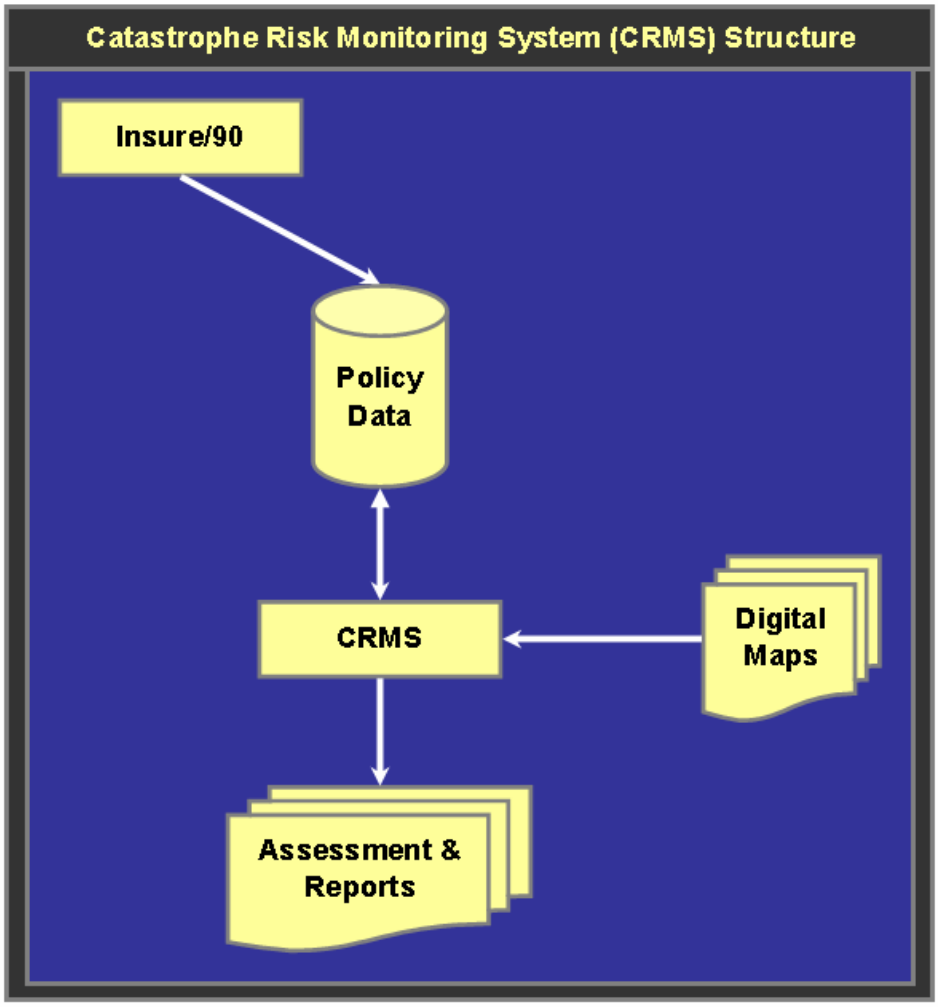


Figure 12. Catastrophe Risk Monitoring System (CRMS) Structure

Risk engineers and risk engineering analysts are provided with handheld GPS receivers to determine the projected coordinates (latitude and longitude) of the properties being insured. The initial readings obtained from the GPS units are treated as preliminary and adjusted after a verification process. Verification involves validation of the readings against existing detailed road network, map information, landmarks and actual information gathered from the site location.

Outlook

In the second phase of CRMS, additional hazard and assessment maps for Metro Manila such as land subsidence-prone areas, tsunami-prone areas, detailed geologic maps and many others will be added. It will also include recent updates on earthquake hazard maps which will incorporate the results of the recently conducted Metro Manila Earthquake Impact Reduction Study.

Likewise, other key cites and major locations or regions (e.g., Cebu City, Davao City, Economic and Processing Zones) will be included in this phase and will similarly have the same functions and features of CRMS version 1.0.

Conclusion

This paper presents the benefits of GIS and GPS not only for military application but also for the non-life insurance industry.

The very basic function of ArcView 9.0 is utilized to provide optimum solutions to the needs of the insurance business.

Most underwriting data are geographically related and can further be visualized through a spatial component (e.g., maps). With GIS at hand, underwriting skills and techniques are enhanced as the views, knowledge and understanding of the natural hazards and their effects become clearer.

With CRMS utilizing GIS as its engine for database management and providing a geographical user interface, it has allowed Standard Insurance to perform data analyses with better risk management and decision making.

Likewise, CRMS has enabled us to gain uniformity in risk assessment and report results as information emanates from a single database source. Report results will likewise be transparent across the users and access to statistical information will be more reliable and of better quality.

It will be interesting to look forward to when the CRMS will evolve and be further enhanced through data quality enhancement, addition of new applications and functions, addition of new maps, enhancement of existing applications and better quality and up-to-date natural hazard maps.

Standard Insurance Co., Inc. pioneered the GIS implementation in the country and it apparently made a precedent in the Philippine insurance industry!

Acknowledgments

The author would like to thank Mr. Ernesto T. Echauz, president and CEO of Standard Insurance Co., Inc., for believing in what GIS and GPS can offer as tools for risk management and underwriting purposes. To the Risk Management Department heads, Ms. Beth Castro and Ms. Baby Mitra and Risk Engineering Department head, Engr. Joseph Severino – for risk management and risk engineering inputs. To the Information Technology Department, particularly to Mr. Alf dela Cruz Jr., Mr. Jiggy Garrido, Mr. Rudy Manlapig, and Mr. Exequiel Salcedo – for the systems development. These people helped in making the CRMS possible.

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