Evaluation of Alternatives in Obtaining Structural Elevation Data

EXECUTIVE SUMMARY

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Purpose

Insurance agents and WYO companies have long affirmed that the requirement for Elevation Certificates (ECs) is a major impediment in selling flood insurance. The purpose of this study is to determine if it is appropriate, feasible, and legally possible for FEMA to obtain the elevation data on individual structures and to make this elevation information available in an elevation registry to properly rate the structures for flood risks and flood insurance premiums so that ECs costing hundreds of dollars each would not be needed in most cases for insurance rating.

Requirements for eRating

For eRating purposes, insurance agents need to know if a structure is Pre-FIRM or Post-FIRM, and they need information traditionally included on ECs: (1) street address and FEMA building diagram number; (2) elevation of the top of bottom floor in A-zones or bottom of the lowest horizontal structural member in V-zones; (3) elevations of the next higher floor, lowest adjacent grade (LAG), highest adjacent grade (HAG), attached garage floor slab, and lowest elevation of machinery or equipment servicing the building; (4) Base Flood Elevation (BFE) and flood zone; and (5) number, area and location of flood openings (vents). The latitude and longitude of each structure is desired for long-term maintenance and update of records but these geographic coordinates are not required for rating of structures. Whereas the highest accuracy elevation data is preferred (± 6 inches), FEMA could accept lesser accuracy for eRating by implementing a system of "judgment ratings."

Findings on Legal Issues

The Dewberry/FEMA Law Associates/EOP Foundation "Final Report on Legal Issues" identified no legal issues that would preclude FEMA from establishing, maintaining and making available to insurance companies and agents, or to the general public, an elevation registry containing this required information so long as personal information is not included. Questions regarding ownership of ECs have no bearing on FEMA's right to obtain elevation data and place it in the registry.

Findings on Technical Strategies

Whereas ground-surveyed ECs are the best, having elevations accurate to ±0.5 ft at the 95% confidence level, aerial surveys, including LIDAR and photogrammetry, can cost-effectively provide elevations accurate to 1.0 to 1.5 ft at the 95% confidence level when the lowest and highest adjacent grade (LAG and HAG) are visible from the air; then, vertical offset measurements could be made on-site to compute the other elevations required in a registry.

Although they have some limitations, existing hardcopy ECs could easily and cost effectively be digitized into the registry's database format. Highest quality ECs could be more easily acquired in the future if FEMA develops and encourages surveyors to use a FEMA on-line tutorial to prepare and print hardcopy ECs and automatically populate the registry with selected EC information. The owner's name would be excluded for Privacy Act considerations. This tutorial

would encourage the use of National Geodetic Survey benchmarks and global positioning system (GPS) surveys that provide geographic coordinates in addition to required elevation data -- helping to ensure that new ECs are accurate and complete and will support spatial queries by users.

Elevation Registry

The registry could be available to all via the web. The registry should focus on structure EC data used by insurance agents, floodplain managers, realtors and potential owners to determine flood risks. Registry information, including a downloaded copy of a "virtual EC" produced from registry records, but excluding owner names, could be free to some but available to others for a fee, similar to the way that users pay a fee to FEMA's Map Service Center for downloading flood maps and DFIRM databases. Selected users would be able to query the registry for all records in a community that satisfy certain criteria.

Ideally, to avoid data redundancy, the registry could be hosted by FEMA's NextGen data warehouse. However, for administrative simplicity, FEMA may want to ensure that the registry avoids potential Privacy Act issues. To do this, names and other personally identifiable information should not be included in the registry and cannot be permanently linked to a system containing these items. Therefore, despite some inefficiencies of storage, FEMA may prefer to implement the registry as a standalone database that would merely feed data into the NextGen data warehouse.

Implementation

Based on the cost model developed for this report, the registry could be populated by several means that are cost effective. However, not all of these strategies provide the same level of completeness or accuracy as the current ECs. FEMA could choose to build the registry based only on ECs produced by surveyors or could choose to include alternative, less accurate elevation methods. If FEMA chose to include alternative EC records that are less accurate than conventional ECs, having errors of 1.2 ft at the 95% confidence level for example when photogrammetric or LIDAR data are equivalent to 2 ft contours, FEMA could implement a system of "judgment ratings" that would increase premiums proportionally to the increased uncertainty in the true flood risk. Owners could always choose to pay for a normal EC to reduce uncertainty and premiums, but they will probably do so only if they believe their true elevations should be higher, which should result in lower premiums.

Depending on the strategies chosen by FEMA, the registry could be populated by several means: (a) digitization of existing ground-surveyed ECs from communities, ISO and others; (b) web entry of future ECs by certified surveyors using an on-line tutorial on how to correctly prepare ECs; (c) reformatting of existing FEMA databases (BureauNet, NEMIS and LOMA 2000); and (d) batch entry of elevation records provided by communities using their existing LIDAR or photogrammetry data to determine LAG/HAG elevations and offset measurements to determine other needed elevations. Each of these data sources have different levels of accuracy and reliability that would be tracked in the registry.

To be effective for *e*Rating, the registry would need to have a web portal with interfaces for security-controlled input of data to the registry's database, and output of information needed for *e*Rating. In addition to insurance agents and WYO companies, this portal should also be available to others involved in the NFIP, e.g., floodplain managers who may need to review all records for his/her community, or an individual user who may need to review only a single address record at a time. The registry must identify the source of the elevation information, its

accuracy and effective date, and have the ability to track multiple records per address that may differ and/or change over time. An administrator who can resolve data conflicts should monitor the registry.

Registry Maintenance and Updates

The registry can be maintained and updated by on-line preparation and submission of new ECs by surveyors. Cooperating communities could maintain and update their datasets by EC surveys or through an acceptable airborne remote sensing option combined with on-site measurements. Communities could also help to maintain the registry by volunteering to track their permit files and input new ECs into the registry if not done so automatically by the surveyors; and communities would be encouraged to add additional information such as assessed value and square footage of the structure as needed for other floodplain management purposes. All community input to the registry, however, should be voluntary, with no FEMA mandates. Alterations to structures are difficult to identify from the air or even from the street. Insurance agents should obtain owner certifications, during the insurance application process, to verify no significant structural changes since the last EC was entered into the registry.

Implementation Costs

Dewberry estimates that it would cost $4 million to develop a web-based registry supported by a geodatabase or comparable spatial database, assuming the registry is an enhancement to a current FEMA web site such as that of the Map Service Center. Annual operating costs are estimated at $350,000. It will cost an estimated $50,000 each to reformat the data from three of FEMA's existing databases (BureauNet, NEMIS, and LOMA 2000) in order to obtain nearly 5 million records. It will cost an estimated $2.50 for each softcopy EC (≈35,000) that is reformatted and quality controlled for the registry, and $5 for each hardcopy EC (≈36,000) that is digitized, quality controlled and inserted in the registry. It will cost an estimated $55 to $60 per structure (primarily for on-site vertical offset measurements) to convert existing LIDAR or photogrammetric data into alternative EC records suitable for the registry. This could be done by communities or perhaps funded by FEMA as part of a new floodplain study while other field data are being collected. It costs little or nothing to encourage surveyors to input data through the registry.

Community Incentives

Community Rating System (CRS) credits are FEMA's primary incentive to encourage communities to support the registry, but it is questionable whether CRS credits alone would be sufficient to make a community willing to spend an estimated $55,000 to $60,000, for example, to convert their existing LIDAR or photogrammetric data into 1,000 alternative EC records for the registry. They will need to be convinced of a "greater good" such as demonstrated by Charlotte-Mecklenburg whose development of a local EC database allows them to implement *proactive floodplain management* principles.

Other Partnerships

FEMA's Cooperating Technical Partner (CTP) program encourages communities to acquire LIDAR data for general mapping purposes, made available to FEMA for hydrologic and hydraulic modeling for a FIS, in exchange for FEMA giving higher priority to Map Modernization funding for such CTPs. Community tax records can provide assessed values and structure square footage needed to complete records for *proactive floodplain management* initiatives. Insurance firms too could provide EC files for the registry.

Major Feasibility Issues

Whereas ground-surveyed ECs are preferred, accurate to ±0.5 ft, aerial survey strategies from LIDAR or photogrammetry allow for community-wide batch entry of elevation data accurate to 1.0-1.5 ft at the 95% confidence level when LAG and HAG points are visible from the air. Such strategies would require a change in FEMA policy regarding building elevation accuracy required for elevation rated policies because they provide less accurate elevations. To offset the increased risk, FEMA may consider the use of "judgment ratings" to require higher insurance premiums when the elevation data has poorer accuracy than from a normal EC. Regardless, the potential exists for adverse selection where homeowners with a favorable elevation (for them) in the registry will use that elevation, whereas those with a less favorable elevation will get a new survey; this could result in a tendency for bad data to remain in the system indefinitely.

Conclusions and Recommendations

Dewberry concludes that it is appropriate, feasible, and legally possible for FEMA to obtain the elevation data on individual structures and to make this elevation information available in an elevation registry. However, in addition to cost factors, FEMA and its major constituencies must support the registry for it to be successful.

- FEMA itself might use the registry for checking policies, community compliance, post-disaster response and recovery, and to help insurance agents and WYO companies sell more flood insurance by helping everyone recognize true flood risks and simplify the flood insurance application process. The major disadvantage to FEMA is the estimated $4+ million start-up cost, $5 each for digitizing hardcopy ECs into the registry, and $350,000 annual operating costs.
- With an elevation registry, the insurance industry should ultimately find it easier to sell flood insurance; but until the registry matures, they may still complain that the registry is incomplete or unreliable for its intended use. The insurance industry may be reluctant to provide elevation data to the registry if they believe it negates a competitive advantage.
- With an elevation registry, communities could be more-proactive floodplain managers, and increased CRS credits would result in lower insurance premiums. Yet, the major disadvantage is the time and money (potentially $60,000 per community) necessary to collect data needed to populate the registry. Thus, success may be spotty, successful in communities that provide strongest support, and less successful elsewhere until they learn from other communities that demonstrate strong benefits.

Dewberry recommends that FEMA open a dialog with the insurance industry and the floodplain management community - to promote the concept of the registry. Efforts with these constituencies must succeed before FEMA begins attempts to implement an elevation registry. Only then can steps be taken to implement a registry that is as affordable, accurate, reliable and as useful as possible. All must recognize that the registry will have modest gains at first, but will grow in utility and value as the registry becomes fully populated with reliable data and has effective means for updates.