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SPECIAL EDITION

REAL ESTATE ISSUES

ENVIRONMENTAL CONDITIONS IN REAL ESTATE

AMERICAN SOCIETY OF
REAL ESTATE
COUNSELORS

The Professional Consulting Affiliate of the National Association of Realtors

1991 BALLARD AWARD PRESENTED TO WILLIAM N. KINNARD, JR., CRE and MARY BETH GECKLER

William N. Kinnard, Jr., CRE

Mary Beth Geckler

William N. Kinnard, Jr., CRE, and Mary Beth Geckler, co-authors of the article "The Effects on Residential Real Estate Prices from Proximity to Properties Contaminated with Radioactive Materials," have been named the 1991 recipients of the William S. Ballard Award. The honor, given annually by the American Society of Real Estate Counselors, recognizes the author(s) whose work best exemplifies the high standards of content maintained in *Real Estate Issues*, the Society's professional journal.

The article, in this edition of the journal, presents a case study of three adjacent New Jersey towns that were designated Superfund Sites Areas (SSAs) in 1984 after concentrations of radon gas and levels of onsite gamma radiation were found to be well above regulatory standards. During the research study, conducted between 1980 and 1989, actual market sales behavior of buyers and sellers of all single-family residential property in and around the three SSAs were identified, reported and measured. Both the impact on sales prices and the changes in the volume of sales transactions were analyzed.

William N. Kinnard, Jr., CRE, is president of the Real Estate Counseling Group of Connecticut, Inc., (RECGC). He is professor emeritus in real estate and finance at the University of Connecticut, and a principal in the Real Estate Counseling Group of America. Kinnard also testifies regularly as an expert witness on methodology for real property and personal property valuation. He has authored several books and articles on real estate appraisal and other real estate market-related topics. Mary Beth Geckler, is vice president of RECGC and a licensed general appraiser in Connecticut. She was a commercial real estate lending officer at regional banks in Connecticut for nine years after spending nearly a decade in market research and project advising for clients of public agencies and educational institutions.

Funding for the William S. Ballard Award, which carries an honorarium of $500, is provided by the generous contribution of the William S. Ballard Scholarship Fund in memory of Ballard, a late CRE (Counselor of Real Estate—a member of the American Society of Real Estate Counselors). Previous recipients of the award include Lawrence Bacow (1990), Lynne Sagalyn, CRE (1989), Michael Farrell, (1988), Alexander Bul and Nicholas Ordway (1987), Joseph O'Connor (1986) and James Graaskamp (1985).

Articles for consideration in next year's competition must be submitted to the Society by August 1, 1992.

SPECIAL EDITION FOCUSES ON THE ENVIRONMENT

My first introduction to environmental hazards in real estate was both rude and expensive. Leaking storage tanks from an adjacent property had contaminated the site my client was developing. As a CRE (Counselor of Real Estate), my responsibility was to identify the source of the contamination, determine the extent of the damage and estimate the cleanup costs, none of which were part of the development plan. Public health and safety, re-engineering, liability and recovery of damages were uncommon concerns in real estate transactions 10 to 15 years ago. At that time, neither I nor my partner had any previous experience with this type of problem. The mitigation measures which ensued took valuable time from the construction schedule, and costs soared as scientific testing, legal fees, re-engineering, redesign and interest costs mounted.

In today's real estate market, contamination issues are pervasive. Consideration of environmental hazards is the hot topic of the 1990s for anyone in the industry. To address this concern the Society's Publications Committee decided to produce a special edition of Real Estate Issues. This is the first time an entire edition of the journal has been devoted exclusively to a single topic. And although much has been written and presented on environmental concerns in real estate, the focus rarely has been on how to deal with these problems on a transactional basis. To Counselors, however, a transactional orientation is more in keeping with the professional role we offer our clients.

Lastly, I would like to inform you of the recent passing of a valued colleague. Malcolm Bryce of Calgary served the Society as a member of the Real Estate Issues Editorial Board, an officer and a member of the Board of Governors. Besides his tireless service to our Society, he will always be remembered for the friendship he shared with so many of his fellow members. Malcolm will be missed by all who knew him.

Editor in chief

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SOCIETY NAMES 1991 LANDAUER AWARD RECIPIENT

George M. Lovejoy, Jr., CRE

George M. Lovejoy, Jr., CRE, chairman and director of Meredith & Grew, Incorporated, Boston, has been awarded the 1991 James D. Landauer Award. He received the award in recognition of his demonstrated outstanding professionalism in real estate and for furthering the ideals of the American Society of Real Estate Counselors and its CRE (Counselor of Real Estate) designation.

During his 35-year career in real estate, Lovejoy has acted as a broker, appraiser, manager and consultant. A member of the Society since 1969, Lovejoy served as president in 1982 and has been chairman of numerous committees. He currently is secretary-treasurer of the Society's Educational Development Trust Fund.

In other related activities, Lovejoy is a past president of the Greater Boston Real Estate Board, the Greater Boston Building Owners & Managers Association and the New England Chapter of the Institute of Real Estate Management. He also is a member of the International Council of Shopping Centers and the Urban Land Institute.

In addition to his real estate career, Lovejoy is dedicated to his great interest in the out-of-doors and conservation. Much of his time is devoted to land in New Hampshire which he has assembled over a 30-year span. The property has been permanently preserved for forestry and wildlife through a foundation which Lovejoy established. These interests are further expressed by his chairmanship of the Fund for Preservation of Wildlife and Natural Areas and by his presidency of the New England Aquarium. Lovejoy also serves as a trustee of Radcliffe College and director or trustee of seven Scudder mutual funds.

The Landauer award is named for the late James D. Landauer, CRE, who played a key role in the establishment of the Society and the preeminence of the real estate counseling profession. Other recipients have included CREs Roland Rodrock Randall (1986), James E. Gibbons (1987), Roy P. Drachman (1988), John Robert White (1989) and Boyd T. Barnard (1990).

REAL ESTATE ISSUES

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THE PRESIDENT SPEAKS

A SAFER PLACE TO BE

"Contamination", "the environment", "asbestos" are words seldom heard in real estate circles 25 years ago. Today they are some of the most important expressions in our real estate lexicon. Society's awareness of the environment has resulted in new laws and the inevitable legal battles which follow. These events have added new and confusing components to the real estate equation.

Three Mile Island, the Love Canal, the John Mansville asbestos case and other major news making events not only have heightened our concern of problems in the environment, but also have made us quite aware that we are seeing only the tip of the iceberg. The tragedy at Chernobyl and the recent events in the Eastern Bloc European nations also have given us a peek at the very, very serious environmental problems prevailing in that part of the world.

As a real estate counselor, the CRE has a responsibility to keep himself and his clients well informed on this important subject. Your editors, knowing the relevance of this topic to the real estate professional, decided to devote one complete edition of *Real Estate Issues* to environmental problems. The nine articles selected focus on these concerns from a practitioner's point of view. While several cite case studies of real world situations, all have a message to convey. These topics are not to be taken lightly nor should they be handled by amateurs.

The Society believes this edition of the journal can serve as a useful guide and reference to the user of real estate services, lenders and real estate practitioners. With proper guidance and carefully selected technical assistance, environmental risk can be mitigated and transactions consummated in a cleaner, safer world.

Eugene P. Carver

Eugene P. Carver, CRE
President
American Society of Real Estate Counselors

LENDERS' PERSPECTIVES ON ENVIRONMENTAL ISSUES

Environmental contamination does not necessarily discourage real estate lending.

by Patricia R. Healy
and John J. Healy, Jr., CRE

In the fourth quarter of 1990, The Hanford/Healy Companies (HHC) conducted a survey of major real estate lenders. The purpose of the survey was to quantify lenders' perceptions of environmental risks and the degree to which these perceptions affect underwriting policy. Individuals from 57 institutions were interviewed, including the largest 25 banks in the country,[1] the largest 15 banks in California,[2] and the largest five foreign bank branches in the United States.

It should be noted that more than one person from some of the larger institutions were interviewed, namely, a lending/credit officer and an officer from the appraisal/environmental services area. The survey percentages reported in this article consequently do not always reflect the number of institutions contacted. Survey percentages also vary because some lenders did not have an opinion about a specific survey question or felt that more than one response was appropriate or individuals from the same institution had differing opinions.

The survey consisted of eight questions, each of which had multiple parts (see Exhibit I).

Questions 1 through 3 of the survey addressed the lenders' relative concern about specific environmental issues, such as underground storage tanks and unencapsulated asbestos. Questions 4 and 5 addressed environmental audits and the use of outside environmental consultants. Question 6 linked environmental issues to the appraisal process, while the last two questions focused on underwriting standards.

The results of the survey were compiled in an indepth report. As it would be impossible to duplicate all of the results herein, this article highlights some of the more significant responses to the survey questions.

Groundwater Contamination: The Greatest Concern

Of all banks responding, 41% believed groundwater contamination was the greatest concern among five specified environmental issues: underground tanks, unencapsulated asbestos, encapsulated asbestos, groundwater contamination and toxic inventories (Table 1). Unencapsulated asbestos was a distant second, with 14% of the banks ranking it as their primary environmental concern. Not one bank categorized groundwater contamination as the least

Patricia R. Healy is a principal of The Hanford/Healy Companies and is a licensed real estate broker in the state of California. Her academic activities include guest lectures at the University of Virginia and the American Institute of Banking and previous service as a faculty member of St. Mary's College.

John J. Healy, Jr., CRE, is a founding principal of The Hanford/Healy Companies, a national firm specializing in real estate appraisal, consulting, asset management and advisory services. He holds professional designations awarded by the Appraisal Institute and the American Society of Real Estate Counselors.

EXHIBIT I

Hanford/Healy Companies' Environmental Risk Survey Questions

1. Would your institution lend on a property knowing it:
   a. Had underground storage tanks.
   b. Contained unencapsulated asbestos.
   c. Contained encapsulated asbestos.
   d. Was surrounded by contiguous parcels with environmental problems.
   e. Had tenants that might use toxic materials.
   f. Previously had some contaminations but has been cleaned up.
2. On a 1 to 5 scale, rank the following environmental issues according to their concern, with 1 being the least worrisome and 5 being the most worrisome:
   a. Underground tanks.
   b. Unencapsulated asbestos.
   c. Encapsulated asbestos.
   d. Groundwater contamination.
   e. A tenant who stored toxic materials.
3. Regarding the above environmental issues:
   a. Which issue is the greatest concern to your institution?
   b. Which issue is the least concern to your institution?
4. In regard to environmental audits:
   a. When is a Phase I audit required?
   b. Does the lender or borrower order, deliver and pay for the Phase I audit?
   c. If the borrower orders a Phase I audit, must the environmental consultant be approved by the lender?
   d. If the lender orders the audit, which banking area issues the order and who is responsible for the interpretation of the audit?
   e. Do you have any loans on property where an environmental cleanup is being conducted—other than property containing asbestos?
   f. If so, did your institution lend the money for the cleanup?
5. Does your institution hire outside consultants to aid in review of environmental audits?
   a. What types of consultants?
   b. When are they retained (under what circumstances)?
   c. Do you hire different consultants depending on the nature of the environmental problem?
6. With regard to appraisals:
   a. If the presence of contamination has been proved, do you ask appraisers to consider the known contamination in the appraisal process?
   b. Who is responsible for informing the appraisers of the contamination?
   c. In your opinion, have appraisals of previously contaminated properties that have been cleaned up reflect any loss in value?
7. Are the following underwriting standards on loans adjusted when a property has a potential or an actual environmental problem?
   a. Loan to value ratio.
   b. Borrower indemnification.
   c. Personal liability.
   d. Interest rates.
8. Have your underwriting standards been changed since the Fleet Factor court decision?

disturbing issue. In fact, when rating the five specified environmental issues on a scale of 1 (least worrisome) to 5 (most worrisome), 87% of the banks believed groundwater contamination rated 4 or above.

Conversely, 46% of the banks believed that encapsulated asbestos was the least worrisome *vis-à-vis* the other environmental issues. On the 1 to 5 scale of risk, 71% of the banks rated encapsulated asbestos at 3 or below.

Less than 40% of the banks would consider lending on a property located contiguous to a parcel that was environmentally contaminated (Table 2). Not one of the foreign banks was interested in lending to such a borrower, and only 22% of the California banks would consider lending on a property with this risk.

While 61% of the banks said they would lend on a property with an underground storage tank (Table 2), approximately 66% gave the caveat that the property must pass a Phase I environmental analysis and be on an ongoing monitoring program. (As an aside, 81% of the national banks stated they would lend on property with underground tanks.)

Finally, and of most significant interest, were the survey results related to previously contaminated property after successful remediation. More

TABLE 1

Issues Identified as Greatest Environmental Concerns by Financial Institutions

	Underground Tanks	Unencapsulated Asbestos	Encapsulated Asbestos	Groundwater Contamination	Toxic Inventories	All are of Equal Concern
	%	%	%	%	%	%
National Banks	11	21	0	44	8	16
California Banks	16	6	6	28	22	22
Foreign Banks	0	0	0	75	0	25
Total	12	14	2	41	12	19

Source: The Hanford/Healy Companies

TABLE 2

Environmental Issues Affecting Lending

Would your institution lend on a property knowing it had. . .	# Institutions Represented No.	Yes Responses %	No Responses %	Maybe Responses %
Underground storage tanks	54	61	28	11
Unencapsulated asbestos	56	36	48	16
Encapsulated asbestos	56	57	27	16
Contiguous contamination	55	38	40	22
Toxic inventories	55	45	35	20
Ongoing cleanup	55	40	52	8
Previous contamination	56	84	3	13
Weighted average	56	52	33	15

Source: Hanford/Healy Appraisal Company

than 84% of the banks reported that they would have no problem lending on such a project; the perceived stigma of prior contamination consequently does not appear to be significant.

Phase I Audits A Requirement

Seventy-two percent of all national banks (and 100% of all foreign banks) would require a Phase I audit on any loan secured by real property. While only 22% of the California banks would require a Phase I audit on any loan for real property, 78% would require an audit if contamination were known or likely. (There may be some bias in these responses as, on average, the exposure to contaminated properties by California banks may be limited by their overall smaller size *vis-à-vis* foreign and national banks.)

Eighty-one percent of the banks would require a Phase II audit if the Phase I work indicated that there might be some environmental concerns. The remaining banks indicated that they would not undertake further due diligence if a Phase I report was unfavorable.

The national banks were again the most progressive in granting loans on properties that were being cleaned up (other than those that were removing asbestos). Fifty percent of the national banks reported their institutions made loans on such properties, compared with 24% of the California banks and 20% of the foreign institutions. Of those institutions that had loans on properties under remediation, 61% said that their institutions had lent the money for the cleanup of some of that property.

It appears that the borrower, not the lender, orders the Phase I audit (68% of all responses), receives the document (66%) and pays for the audit (85%). However, 80% of the banks required that the environmental consultant conducting the audit be approved by the lender, and 57% percent considered using an outside consultant to aid in the audit review. The consultant most often identified was an engineer, and the engineer most often would be involved when major environmental problems were present or when special technical expertise was required.

Appraiser's Role

If the presence of contamination was proved, 61% of the banks would instruct the appraiser to consider contamination in the appraisal process. The banks would not necessarily require the appraisal to assess

the cost of a cleanup (and its implication on the value of the property) but the appraisal should indicate the presence of such contamination in the property description and note that the appraiser did not assess the impact of the contamination on the property's value.

Almost 50% of the banks did not believe there was any loss in current value on properties that had been previously contaminated but subsequently had been cleaned up; 37% were unsure of the effect on value or had never been faced with that issue. Again, contrary to common perceptions, only 19% of the institutions perceived that there was a stigma on property that had been previously contaminated.

Underwriting Standards Adjusted

On properties with an actual or potential environmental problem, 66% of the banks would require additional indemnification from the borrower; 46% would consider adjusting the loan to value ratio; 60% of the institutions would require personal guarantees (or some personal liability). Conversely, only 21% would consider an interest rate adjustment.

The Fleet Factor case, which raised uncertainty about the exemption of a lender from liability for cleaning up environmental hazards, is considered a landmark. Nevertheless, survey respondents were divided on whether it affected underwriting standards; 47% believed the case did affect standards and 45% believed it did not. Effectively 100% of the individuals who were aware of the decision believed that, regardless of the actual impact, the court ruling had heightened the lending community's level of concern about environmental issues.

Summary

The results of the survey demonstrate a significant level of knowledge about environmental issues among lenders. Although environmental contamination does not appear to discount a bank's interest in lending on a specific property, in all cases it does require a significantly more stringent due diligence process.

As is true in most industries, active involvement in certain aspects of the business results in specialization. Clearly, some banks that are more actively involved in environmental issues have become more comfortable with environmental risk, perceived or actual, than others. Nonetheless, the survey shows that no single environmental issue would result in a blanket rejection of a loan on a contaminated property by an institution. That, in and of itself, appears to be noteworthy to us.

NOTES

1. The 25 largest banks were identified in the American Bankers Association 1991 listing of U.S. banks.
2. The 15 largest banks in California did not include banks that had previously qualified as national banks in the book of lists for San Francisco and California.

ENVIRONMENTAL COUNSELING CASES

Two case studies illustrate how one real estate appraiser analyzed difficult environmental pollution problems.

by Max J. Derbes, Jr., CRE

Case 1–Where's The Plume?

Perhaps the strangest reason I ever received an assignment was because two service stations had been leaking gasoline into the underground water aquifer of some commercial lots in an office park at a small city distant from New Orleans. The attorney for one of the service station owners solicited a prominent local appraiser to assist him in the defense of the case. After rejecting the solicitation, the appraiser advised the attorney that there was, in his judgment, only one appraiser/counselor who was crazy enough to accept this sort of assignment and then gave the attorney my name.

As can be noted from Figure 1, the two service stations were located at the intersection of Office Park Road and East-West Road.[1] Behind the service station on the northwest corner of this intersection was a first class motel. The service stations and motel were at the top of a small hill: the land sloped downward from this location to Jimmy Road which was developed with houses. North of the two service stations was an office park, 50% of which had been developed with one- and two-story small office buildings. The shallow, underground aquifer ran diagonally across Lots A, B, C and D; however, only a small amount of potential pollution affected the rear of Lot D. At the time of the original contact, the precise location of the plume was not known.

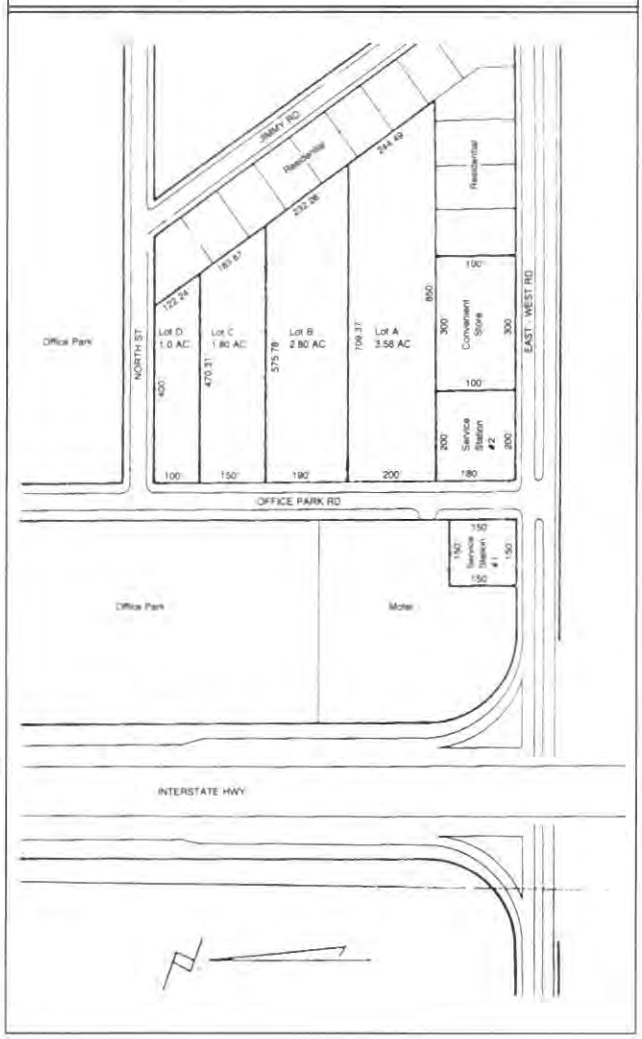
The fact that contamination from the two service stations had infiltrated into the shallow aquifer was well known, and the scope of the infiltration was believed to be extensive because strong gasoline fumes were present in a home at the bottom of the hill on which the commercial land was located. The home was purchased by the offending service station owners soon after the fumes were discovered.

Furthermore, two appraisals by local, designated appraisers indicated a loss in value to the four lots that were affected by the contamination. One appraiser even went so far as to place a negative value on the property for 20 years of taxes, liability insurance and snow removal costs. The discounted worth of the annual costs of holding the property until biodegradation took place produced a negative value of more than $50,000.

In defense of the property owner's appraisers, it is likely that they submitted their valuations without knowing the precise location of the plume. The appraisers had been told that structures could be built over the contaminated areas provided the buildings' foundations were properly vented; however, such projects would be considered highly speculative in terms of mortgage availability and risky

Max J. Derbes, Jr., CRE, *is president of Max J. Derbes Appraisers and Real Estate Consultants, Inc., New Orleans, LA. A practicing real estate consultant, he has experience in dealing with pollution matters in Texas, Louisiana, Iowa and Michigan. He has contributed to* Real Estate Issues, the Appraisal Journal *and other national publications. Much of his current practice involves large industrial properties.*

Figure 1. Location of the Service Stations and the Affected lots



in terms of obtaining fire and extended coverage insurance. Therefore, based on this knowledge, the appraisers estimated total market value diminution.

By the time I became involved in the assessment of this pollution problem, the two service station owners, with the cooperation of the state environmental agency, had begun remedial action. The tanks and fittings of both service stations had been excavated and replaced, and gasoline was being extracted. Two points of interest were revealed concerning the leakage. First, the leaks at Station No. 1 were not from the tanks but from the fittings that discharged gasoline every time the pump was used. Second, the stations handled different kinds of gasoline, and both kinds were found underground.

With the assistance of a local appraiser, I came to a preliminary conclusion about the market value of the four commercial lots as if there were no pollution. As it turned out, this value and the values given by the property owner's appraisers were not substantially different. However, at this point, I was asked to delay any further action. I presumed the delay was because the environmental people had not finished their studies.

Legal Delays

Actually, the delay was caused because the property owner's attorney put in a claim for rental of the properties for the period of 20 years, the period of time during which biodegradation likely would take place. After considerable legal proceedings, the highest court in the state ruled that the measure of damages was the diminution in market value. The court ruled out rent for the damage period as a criterion.

After a considerable time period during which the attorneys endeavored without success to settle the matter, I was brought back into the picture. As I had reported to the service station owner's attorney all along, I was not sure that the results of my appraisal would be favorable to his client. In spite of this warning, he wanted me to proceed.

Highest And Best Use Revisited

The obvious highest and best use of the commercial lots affected by the pollution was for the development of small office buildings. The office park already contained small- and medium-sized, one- and two-story buildings. Therefore, the highest and best use of the property was for the development of one to four office buildings on the four lots. It was impossible to determine if the site would be acquired for one large building or for two mid-sized or three or even four smaller buildings. After checking the building code and the parking requirements, I determined that a total of 100,000 square feet of offices would be used in a one-story building and perhaps as many as 130,000 square feet in a two-story building.

All of the land in the office park was controlled by one developer, whose pricing policy had been more or less uniform per square foot; the location, size, depth or even time of sale did not make much difference. Because he developed many of the structures on a lease-back basis, the developer was also the purchaser of his own land. The developer had venture partners in some transactions, and his outright sales conformed to price patterns. Comparable sales therefore were considered to be reliable.

These sales indicated a value of about $2.00 per square foot. I questioned if the narrow frontage of Lot A and its longer depth should be discounted; however, Lot A could be developed for some higher uses than offices since it was close to the intersection and across from the motel (see Figure 1).

I wondered if selling three or all four lots as a unit might discount the price per square foot. However, sale prices per square foot in the office park were the same regardless of size.

I also wondered if a discount for the rate of absorption might not be in order because the rate of sales in the park was slow. Research indicated that competition was scarce. There were no other lots in an organized office park area. Isolated sites along

other highways and major streets were available at variable prices per unit; however, there was competition from commercial users or difficulties with utilities, topography or zoning associated with these sites. Further, none of the sites had the office park's advantages of proximity to the interstate highway combined with an identifiable motel. Actually, the office park was a well-conceived project. The lack of absorption was due primarily to limited development in this small city.

Problem Solving

When I was called back into the picture, I requested the attorneys meet with the environmental engineers. These engineers, along with the attorneys, believed that the best solution to the situation would be to convince a typical buyer that buildings could be constructed on the property if the foundations were vented. As indicated above, because of mortgage loans and insurance problems, I did not believe this solution to be feasible. Buyers are leery of properties that require systems to assure safety; they fear a breakdown of any system. Also, inasmuch as there was so much land elsewhere where buildings could be constructed (remember, this property was on the edge of town), it would be very unlikely that anyone would buy these properties if he was required to vent the foundation of any building built thereon. Therefore, I was convinced that the property owner's appraisers likely were correct in their prediction of a total loss in value, at least for 20 years, if this was the only solution.

I requested the environmental engineers to explain the circumstances of the infiltration, the cleanup efforts, etc. During their explanation, I learned that the actual location of the gasoline plume was limited to an area extending from southwest to northeast. Since the two service stations were located on top of the hill, the gasoline spills actually had traveled down to the water aquifer to a depth of from 15 feet to 20 feet. The spilled gasoline then had taken the path of least resistance toward the bottom of the hill. Because gasoline is lighter than water, the gasoline actually sat on top of the water in the aquifer. Shallow wells had restricted the extent of the infiltration of the gasoline (see Figure 2), with areas to either side of the plume completely free of contamination.

The precise location of the plume provided information on the parts of the four lots that were free of contamination and the areas on which construction could take place. Because the area of infiltration could be identified, the state environmental agency would allow unrestricted construction in areas that were not affected.

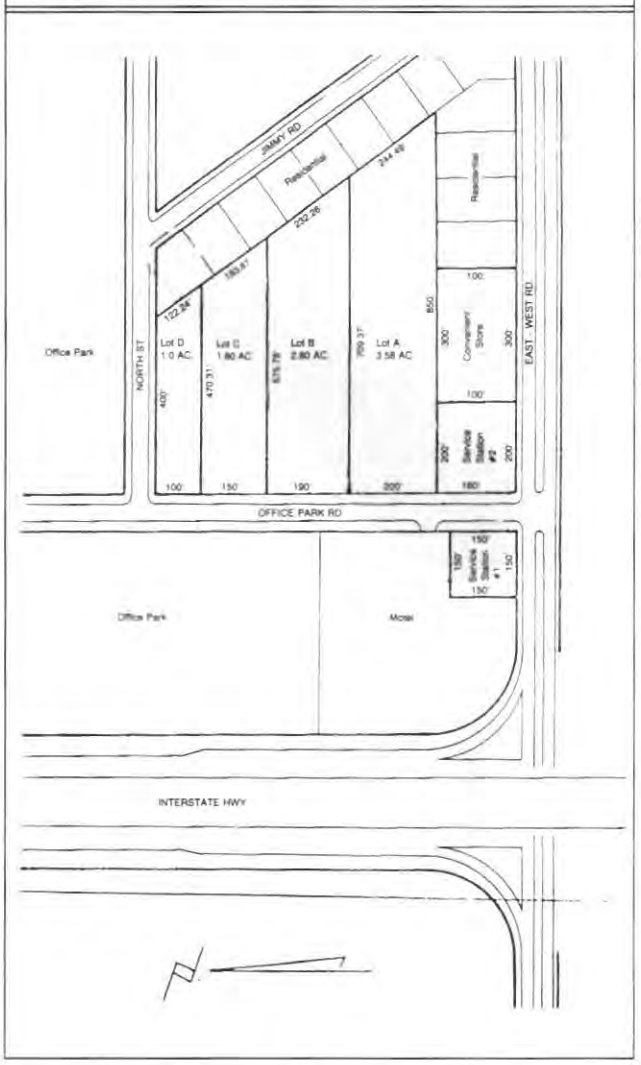
At this juncture, I requested that the attorneys involve capable architects to ascertain what structures could be built on the properties. It was later shown that:

- A building could be built on the rear of Lot A and part of Lot B that would be almost as large as two buildings built on these two lots before the infiltration. The building would have to be situated toward the rear of Lot A with parking in the front of Lot A and over most of Lot B.
- Buildings could be built on Lots C and D of the same size as buildings built before the infiltration. Buildings would have to be placed at the front of Lot C. Because Lot D was almost totally unaffected by the infiltration, buildings could be located anywhere.

After studying the situation in full, I concluded that the market value diminution was approximately 11%. This figure was based on the restriction in the total size of buildings that could be accommodated on lands to either side of the gasoline plume. Even allowing for psychological factors, I believed that the diminution in market value would not exceed 25% of the total previous value. This figure assumed that the cleanup operation would continue until a clean bill of health was given by the state environmental agency.

Offers in excess of the diminution estimates already had been made to the owner. Upon receipt of

Figure 2. Location of the Plume



my report (I was told), the owner agreed to the prior settlement offer figure.

Counseling Lessons

Whenever a gasoline spill is found, the natural inclination is to presume the worst and, until proved otherwise, that the market will react in the same way. Therefore, it is incumbent on all concerned to determine exactly what can and cannot be done with the property.

Appraisers for the property owner in this case were told or presumed that the lands could not be used for anything for 20 years. This information had been a condition of their appraisals; however, it proved to be incorrect.

In light of the actual situation, differences in the highest and best use of the property should have formed the primary basis of the diminution of market value, with the psychological factor of market perception also taken into account.

In this case, I probed until I had sufficient facts to measure the potential diminution in value of the property. For the market reaction factor, I endeavored to logically compare the price of the subject lots with their restrictions against the prices of other lots in the area and to determine: At what point would a buyer be persuaded to buy the subject lots rather than pay the higher unit price for other lots in the area?

On an overall basis, I estimated that the subject lots would be a good buy at 75% on the dollar, reasoning that this price would provide enough incentive to persuade some buyers to purchase one or more of the subject lots rather than other lots. The fact that only three buildings could be built on the four lots was not evidence of loss in value. My studies had indicated that, in all likelihood, purchasers would buy two of these lots rather than one because most of the building projects located in the area, to date, were of this nature.

Case 2–Noise Pollution

Environmental factors in residential neighborhoods prompted the Department of Transportation and Development (DOTD) of the State of Louisiana to undertake an investigative study to determine the effect, if any, of highway noise on adjacent residential property values. The department requested that I formulate a procedure that could be followed routinely to derive a fair measure on the effect of noise on property value. The methodology developed was as important as the results of the study.

Previous studies had endeavored to measure the effect of noise pollution by various statistical means. The first study used stepwise multiple regression of dissimilar sales of property. Proximity to highway noise was but one of 95 variables tested. Inasmuch as this study included only 200 bona fide sales in four study areas, the sample size seemed small and the number of variables large. The second study used resale of properties that abutted the highway, those that were in the impact zone and finally those that were removed from the source of the noise. Multiple regressions in this study yielded deviations of less than 4.9% from any data. Furthermore, some data from this study was contradictory to the general trend. The third study used the average of sale prices of properties located near to and far from the noise source. In this later study, two of five study areas showed no difference in average prices for homes abutting the highway compared with prices for homes near or far removed from the noise source.

It was my judgment that the methodologies used in the three studies were unacceptable for deriving conclusions about the impact of highway noise on property value. The basis of my methodology was the view that individual properties proximate to a highway noise source of greater than acceptable levels should be compared individually and analytically with similar properties away from the noise source. A sufficient number of these analytical, direct comparisons should produce a meaningful trend.

I also endeavored to measure annual resale percentage increases of similar houses, which required inspecting homes and interviewing their owners to determine if any alterations or rehabilitation had been done between the original purchase and the resale. I did not accept sale prices as valid criteria for resale percentage measurements.

I also believed that rentals of apartments in buildings abutting highway noise sources should be compared with the rentals of similar units in buildings removed from the noise source. In this connection, I needed to ascertain if there were more vacancies or longer rent-up times for apartments near the noise source. I also inquired how many times tenants requested to be moved from an apartment near the noise source to a less noisy location.

Selection Of Properties

With the assistance of George H. Cramer, II, environmental engineer with the Louisiana DOTD, preliminary noise level readings were taken at the rear of houses and apartments in various locations to determine if noise was above acceptable levels according to the Federal Aid Highway Program Manual. In all cases, noise levels were above acceptable levels for houses or apartments immediately adjacent to a highway right-of-way; however, no noise levels above acceptable levels were found for houses or apartments in the next tier. Noise levels diminished drastically as the distance from the noise source increased.

Some interesting observations about highway noise were revealed during this testing. Motorbikes and motorcycles tended to produce the highest noise levels. Second to these were the large tractor/trailer rigs moving at high speeds. The noise level of an ordinary passenger car accelerating just a few feet away from the test machine produced exceptionally high noise levels. Because of the familiarity with the passenger car, the noise levels produced by acceleration of these vehicles tend to be ignored.

Residential subdivisions with similar types of housing were identified on interstate highways in the Metairie suburb of New Orleans, in the smaller sized city of Baton Rouge and in the relatively small city of Slidell. In all subdivisions selected, the lots of the houses backed onto the right-of-way line of the highway. By searching into sales activity along the interstate highways in different size cities, I could determine if there was any variance in the impact of noise on property values.

The noise levels along the interstate tended to be higher than along other roads. However, some local collector roads carry heavy traffic that is physically more proximate to the houses fronting them than to the houses on interstate highways. I selected a location in New Orleans with homes in the middle income bracket and another location in Baton Rouge with low-middle or upper-low income housing. I also studied garden-type apartment projects along I-10 in both New Orleans and in Baton Rouge because they offered the opportunity to study rents, occupancy and rent-up time for units next to the highway and identical units to the rear. Furthermore, the owners/managers were able to provide insight about any change in these variables over an extended period of time.

Method Of Comparison–Single Family Homes

Sales of virtually identical home models in a subdivision were separated by model for purposes of comparison. Sales of matching models a year before and a year after the sale of the subject property near the noise source were used for comparison. Sales were adjusted for time, using average monthly resale increases in the subdivision. Sales also were adjusted for lot size differential.

Sales of the comparison models were chosen that had the least amount of difference from sales of subject property. Generally, about three sales of models away from the noise source were compared with each sale of property near the noise source. Differences in each case were recorded. Individual sales as well as individual variances and the overall average variances were identified in the report. Anyone wanting to trouble with the validity of the data or the comparison method may research the actual sales used and individual comparisons made.[2]

Method Of Comparison–Apartments

Several garden apartments fronted interstate highways in New Orleans and in Baton Rouge. I researched a number of these to determine if at the present time or at any time in the past there was a rent differential between the apartments that fronted the interstate and those that were located in the rear of the complexes. Apartment rentals, occupancy and renters' requests to move were relatively easy to study because I chose to review apartment complexes that had identical units along the interstate highway and others far removed from the highway. If noise was a detrimental factor, it should be reflected in rents, occupancies or requests to move in some or all of the apartment complexes studied.

Conclusions

The study endeavored to find an adverse effect on property values from highway noise. If I could uncover and quantify a diminution noise factor by sampling individual single family home sales and apartment rentals, this factor would set the limits of the effect on property values. However, the evidence from the study indicated:

- There tends to be imperfection of plus or minus a limit of 7% of the norm of prices in single family home sales. Some evidence supported a relatively minor diminution in value of homes near the noise source; other evidence indicated homes at the noise source sell for more. I attributed this finding to the imperfection of the market rather than to any other factor. I concluded that there was no discernible pattern of diminution in value as a result of highway noise in the varied situations studied.
- There was a diminution in value of the houses that fronted a heavily traveled collector road in Algiers, a New Orleans westbank suburb. Upon investigation, I learned that the cause of the diminution was two fold: (1) In order to get out of the driveway of the houses, the cars had to back into heavy, fast-moving traffic; and (2) the street was used by teenagers as a drag racing strip in the middle of the night.
- Apartments fronting the interstate highway were often preferred by tenants, particularly older people. Primarily because of the bright highway lights and the constant activity, the tenants found these apartments safer places to live than the rear apartments. Many people also preferred to view traffic rather than other apartments or parking areas, etc.

Undoubtedly, some people find noise, particularly high levels of highway noise objectionable. However, the test on the effect of noise pollution is not what particular individuals feel or think but what the market reaction is. The proposition that a home or apartment located farther from a noise source is worth more than one abutting the noise source cannot be supported unless it is reflected in actual market transactions.

In the climate of southern Louisiana, people often are shut off from most outside noise because their windows are closed while using their air conditioning. The terrain in this area typically is flat, which should produce lower level noise readings than those produced in hilly country areas in which traffic noise can bounce from elevated terrain on the opposite side of the highway.

Finally, the distance from the rear of the houses or the walls of the front apartments to the noise source was such that some extremely high noise levels were partially dissipated by the time the noise reached the living area. Therefore, noise effect could occur in other areas where the highway or highway structure is physically closer to the buildings.

Therefore, this study is not a total answer to the assessment of highway noise pollution as it relates to market value. Nonetheless, within the broad scope of the methodology used, the study tended to provide (what I believe to be) reliable indicators of actual market conditions at the time. More importantly, the study provided a logical methodology for studying the actual effect of noise on market value. Anyone can have an opinion or a judgment, but the true test of noise pollution is market reaction as reflected by reliable data that has been analyzed in an objective manner using a logical methodology.

NOTES

1. At the request of my client, some of the information in Case 1 has been altered to protect the confidentiality of the parties.
2. "The Effect of Highway Noise on Residential Property Values in Louisiana," Report No. FHWA-LA-78-208D, is available to the public through the National Technical Information Service, Springfield, VA 22161.

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4. Number all tables consecutively and type double-spaced on separate pages. All tables are to have titles.

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6. Title of article should contain six words or less with an active verb.

7. For uniformity and accuracy that is consistent with our editorial policy, refer to the style rules included in *The Chicago Manual of Style*.

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The editorial board of *Real Estate Issues (REI)* is accepting manuscripts in competition for the 1992 Ballard Award. The competition is open to members of the American Society of Real Estate Counselors and other real estate professionals. The $500 cash award and plaque is presented in November during the Society's annual convention to the author(s) whose manuscript best exemplifies the high standards of content maintained in the journal. Any articles published in *REI* during the 1992 calendar year (Spring/Summer and Fall/Winter editions) are eligible for consideration and must be submitted by August 1, 1992.

LANDFILLS AREN'T ALL BAD: CONSIDERATIONS FOR REAL ESTATE DEVELOPMENT

Modern landfill sites can be transformed from unwanted pieces of property into assets for their surrounding communities.

by Michael L. Robbins, CRE, Michele Robbins Norman and John P. Norman

What? Real estate development on a landfill! Are you crazy? Well, maybe. Building near or especially on a landfill is a challenging idea that requires careful consideration of complex issues such as site use, architectural modification, safety and liability. After describing the basic components of a modern landfill and discussing some common misconceptions about landfill development, this article addresses issues of interest to the real estate developer by answering the following questions:

- Why consider development on a landfill site?
- What types of development work on a landfill?
- When in the life of a landfill is the best time for development?
- What architectural issues need to be addressed?
- What liability comes with owning a landfill property?
- What does the future hold for landfills and their subsequent development?

Components Of A Modern Landfill

The term "modern landfill" refers to a facility that has been engineered so waste may be disposed on land at reasonable cost and with minimum environmental impact. A modern landfill differs greatly from an open dump because of its planned, engineered design and the daily compaction and covering of waste materials (see Figure 1).

Solid wastes placed in a landfill undergo a number of simultaneous biological, physical and chemical changes that result in the decay of organic matter.

Gases and liquids are generated throughout the decomposition of organic matter. A modern landfill is designed to control these decomposition byproducts and minimize their environmental impacts. The following paragraphs discuss the typical manner in which gases and liquids in a landfill are controlled.

Gases

Carbon dioxide and methane are the principal gases produced by the decomposition of organic waste. These gases are vented to the atmosphere in small landfills or collected for use as an energy source, which is economical only for large landfills. The movement of landfill gases typically is controlled by installing

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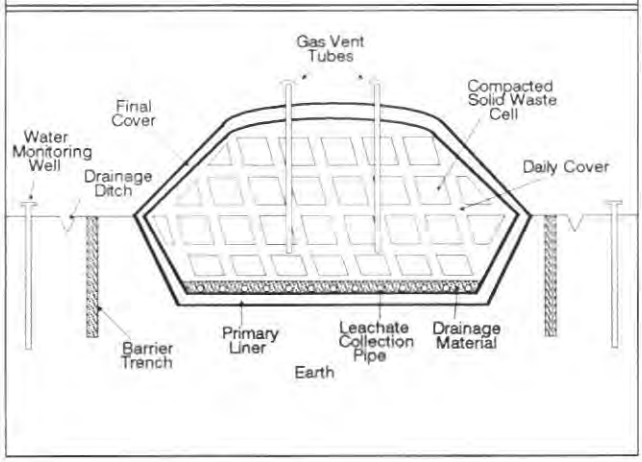
Michele Robbins Norman, *completed her graduate studies at the University of Wisconsin-Madison, where she studied solid waste management in the civil and environmental engineering department. She is interested in combining her technical, environmental training with real estate analysis.*

John P. Norman, *received his graduate degree in real estate and investment analysis from the University of Wisconsin-Madison. He has assisted Robbins with several projects involving wilderness valuation and recreation feasibility analysis.*

FIGURE 1:

Cross-Section of a Modern Landfill



vents made of materials that are more permeable than the surrounding soils. Gas vent tubes release the gases that are generated within the landfill, and gravel barrier trenches surrounding the landfill vent any laterally moving gas that may migrate off the site (Figure 1).

Liquids

The liquid found in landfills is called "leachate," and it arises from the decomposition of wastes and liquid that has entered the landfill from external sources such as surface drainage, percolation from rainfall and groundwater. Leachate usually contains a number of chemical constituents that can pollute groundwater; therefore, a modern landfill is designed to minimize and contain leachate.

The final cover on a landfill is a system of soils that minimizes leachate generation by limiting percolation through the top of the landfill. The final cover typically consists of topsoil which supports vegetation, a middle layer which provides additional rooting depth and a clay layer which protects roots from freezing and thawing.

Under normal conditions, leachate is found in the bottom of landfills; so this is where the major leachate containment measures are constructed. A primary liner of several feet of compacted clay on the base and sidewalls of a landfill reduces or eliminates the percolation of leachate into groundwater.

A layer of drainage material (e.g., sandy gravel) is placed over the primary liner, and a leachate collection system consisting of perforated pipes is built into this material. The leachate collection pipes usually are sloped so the leachate will collect in one low point to facilitate treatment and disposal.

Drainage ditches collect excess surface water and divert it away from the landfill to minimize potential leachate generation. Water monitoring wells around a landfill site are tested regularly to ensure that leachate has not leaked into groundwater.

Common Misconceptions

Refuse Does Not Decompose

Many people believe that waste is simply stored in a landfill and that it does not decompose. Landfills are heterogeneous; decomposition occurs in microenvironments within the landfill (some of which are more conducive to decomposition than others). While it is possible to find isolated pockets of refuse that have not decomposed, the vast majority of refuse in a landfill does decompose. Evidence of decomposition includes the generation of gas, changes in leachate which has percolated through the refuse and contains suspended or dissolved waste and the composition of refuse. Studies have shown that the extent of decomposition is directly related to the amount of moisture in the environment.[1] Thus, waste in landfills in dry, arid climates tends to decompose more slowly than waste in landfills located in temperate or wet climates. It is also important to realize that refuse does not degrade completely because refuse is the result of modern manufacturing techniques which frequently combine degradable materials with non-degradable substances.

Odor

Odor is another attribute that many people associate with completed landfills. However, properly maintained landfills emit little odor. Refuse in a modern landfill is encapsulated within a clay layer, which serves as a protective barrier between the decomposing refuse and the surrounding area and keeps odors within the landfill. Gas vent tubes positioned at regular intervals over a landfill's surface allow methane and carbon dioxide to vent freely. The minimal amount of odor emanating from these vents can be reduced further by placing burners on the vent tubes.

Ugliness

Many people expect a completed landfill to be ugly. However, landfills typically look like hills with short vegetative cover. Gas vent tubes, gas piping leading to a small building, the occasional pump truck and water monitoring wells usually are the only visible features of a completed landfill.

If landfill gas is being collected for use as an energy source, a network of pipes will lead from the landfill to a small building on the site in which the gas will be drawn, compressed and directed to a pipeline. The piping network may be above or below ground. Modern landfills have an underground leachate collection system which must be emptied periodically. The collection system empties the leachate into underground storage tanks or directs it to a nearby sewer system. The only visible aspect of leachate collection is the pump truck that regularly collects the liquid. Water monitoring wells surround the landfill area to determine whether leachate is escaping through the clay base layer and contaminating the groundwater. These wells consist of nothing more than some polyvinyl chloride (PVC) pipe sticking out of the ground.

Why Consider Development On A Landfill Site?

Landfills constitute a temporary use of land. When carefully constructed, filled and covered, they can become valuable, developed sites. Developers should seriously consider landfill sites for two basic reasons: their location and land cost.

Location

When they are originally constructed, landfills typically are located on the fringe of urban areas, far enough away to be out of the sight and mind of the general public but close enough to ensure affordable transportation of wastes. By necessity, landfills are connected with the surrounding community by a network of transportation, utilities and other services; other vacant parcels of land in the area may not have these connections.

As urban areas expand along existing infrastructure, landfill sites often fall in the path of growth and as a result become attractive properties. For example, as a city grows, low density developments and eventually housing extend beyond the urban fringe. While the landfill is in operation, most available surrounding land may be developed for ancillary uses such as shopping malls, churches and parks. As residential density increases, a market may form for an additional shopping center. After waste has decomposed and the landfill has stabilized, the landfill site provides a large parcel of land with transportation, utilities and other linkages.

Views are an important attribute of any real estate development, and the view from the top of a completed landfill should not be disregarded. The landfill siting process is such a time-consuming, laborious and politically ugly process that communities want to go through the procedure as few times as possible. Therefore, communities maximize the life of a landfill by filling it with as much refuse as possible. More garbage can be placed on a site if the elevation of the landfill is increased while the required side slopes (which vary by region) are maintained. The end result of a landfill at capacity (using modern techniques) is a meatloaf-shaped hill rather than a relatively mounded piece of property that blends in with the topography. Consequently, a completed landfill often provides a distant and encompassing view of the area.

Land Cost

As urban land use expands near a landfill, the density of development increases, and land prices rise. At the same time, the availability of vacant land declines. Landfills are considered less desirable than other vacant land and therefore are available at much lower prices. Buyers usually are not interested in landfill property because of fears of liability, concerns about public perception, lack of knowledge about landfill design and refuse decomposition, etc. However, the cost of land is reason enough to consider development of a landfill site as a potential opportunity. All real estate development is risky, and development on a landfill is no exception. However, the money saved on land costs may be used to design and construct a project that takes into account development factors and additional challenges. Consider the following examples:

- In the San Francisco area, land costs range from $500,000 to $750,000 per acre. A developer in Mountain View, California, recently paid approximately $25,000 per acre for a 700-acre parcel that had been the landfilling site for San Francisco's garbage for 13 years. The developer has turned the land into Shoreline Park, which includes a golf course, amphitheater and sailing pond. Revenues from greens fees, theater ticket sales and other park uses are being supplemented by the sale of methane to utility companies.[2]
- Near Columbus, Ohio, a developer is transforming an 80-acre site that includes a 22-acre completed landfill into an industrial park. The proximity of the site to an interstate highway and airport make it an attractive industrial location. Rather than allow the property to remain unused, the city favors development of the landfill site and is contemplating the extension of a road and construction of a bridge to make the property even more accessible to the airport. The developer paid the city $400,000 for the 80 acres ($5,000 per acre) and has nearly recovered his land cost by selling nine acres to an auto parts warehouse operation for $345,000 ($38,000 per acre). Nearby industrial land is selling for between $62,000 and $65,000 per acre.[3]

Just because landfill sites can be purchased for much less cost than nearby property does not necessarily mean that a landfill site is a bargain. Several costs must be considered when acquiring a landfill site, such as the costs of environmental studies, possible cleanup and architectural modifications. Only if the gap between the price of an alternative property and the landfill is larger than these anticipated additional costs will landfill development be advantageous (see Figure 2). It also must be kept in mind that the cost advantage must be large enough to reduce significantly the potential risks associated with landfill property development.

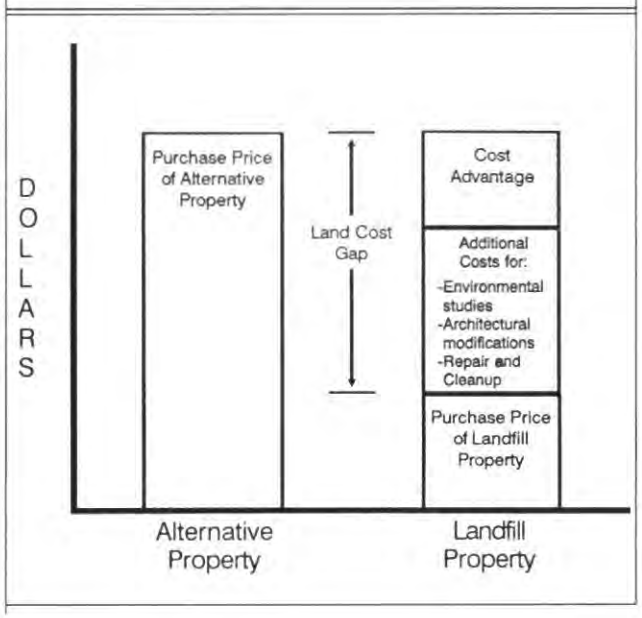
What Types Of Development Work On A Landfill?

Development Constraints

When contemplating landfill development, government regulations, waste type and landfill design and condition must be considered. When a landfill is closed, it is covered with layers of soil to form a cap. For decomposition to occur as planned, the cap and the underlying refuse cells must remain intact. Accordingly, the purpose of government regulation of closed landfills is to preserve the integrity of the site. In most cases, government agencies require approval of any use of the site other than undisturbed refuse decomposition. Some uses, such as building structures on the site, require special approval by

FIGURE 2:

The Land-Cost Gap



government agencies. Recently, however, governments have been approving a variety of developments on landfill sites.

The type of waste deposited in a landfill also determines the options available for reuse of the site. Municipal waste is subject to biological decomposition within a landfill. During this process, methane is generated by micro-organisms as they break down organic material. Methane migrates to permeable areas, and if allowed to collect in those areas, the gas may become explosive. Municipal waste also is subject to settlement. As refuse degrades, the landfill site will settle between 5% and 15%. In cases of poorly compacted refuse, landfill sites have settled as much as 50%.[4] Most settling occurs in the landfill's first five years (in moist climates); however, long-term settling also occurs. Different parts of a landfill are created at different times; so various areas may be undergoing different stages of decomposition simultaneously. These varying stages of decomposition can cause differential settlement.

Other types of waste pose fewer potential development problems. Landfills created with foundry sand, fly ash and demolition debris may be suitable for sophisticated development for two principal reasons. These landfills contain wastes that consist of tightly compacted materials; therefore, they are more stable and less susceptible to settlement, and they have good load-bearing capacities for structures. Also, because the waste they contain has low organic composition, the landfills do not produce methane gas.

Finally, the design and condition of a landfill affect its end use. A real estate developer is always interested in decreasing exposure to risk. One of the most basic forms of risk reduction is to gain more knowledge of the situation. Uncertainty can be reduced if the developer understands the design, construction and maintenance of a landfill site. With an understanding of the design and refuse composition of a particular landfill, a developer can eliminate non-conforming uses and recognize the modifications (and their associated costs) that may be needed for alternative uses.

Various Landfill End Uses

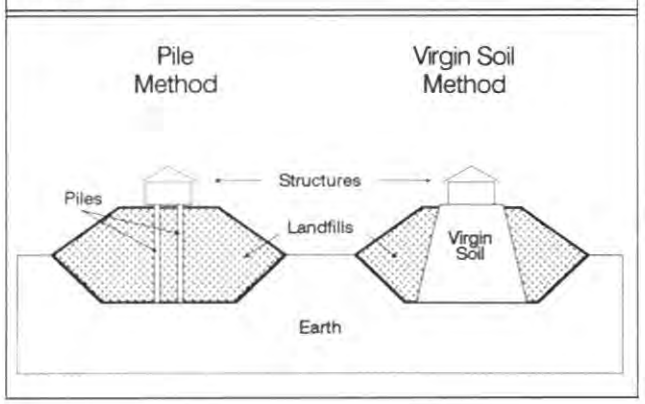
The most common use of a former municipal waste landfill is as open space, often with light recreational facilities such as walking and biking trails, softball and soccer fields and golf courses. Because settlement of a landfill is uneven in the first few years following completion, initial development should require non-permanent and yielding materials. After waste has stabilized, which may take ten years or more, development may include paved areas for parking lots, outdoor storage, tennis courts and roads. The shape of the landfill may be transformed by massive grading and berming efforts using fill so as not to disrupt the integrity of the landfill. Ski hills and toboggan runs have been constructed on transformed landfill sites.

Buildings for residential and commercial use may be constructed on such sites after the land has stabilized and the waste has finished decomposing and ceased producing methane. Depending on the climate, landfill design and other factors, it may take up to 25 years or more for full decomposition.

Buildings may be constructed on a recently closed landfill using one of two methods (see Figure 3). First, pilings may be driven down through the landfill to support the structure. Because the pilings will disrupt the integrity of the site, government approval for development and guidance during construction is necessary. Second, virgin soil on which to build may be maintained within the landfill area. This method requires the developer and/or landfill designer to choose the specific area for the development and create the landfill around it.

When building on a recently closed landfill, developers must give serious consideration to land settlement and methane generation. The following is an exciting example of landfill reuse.

FIGURE 3:



- In Albany, New York, a new public works complex was built on a completed landfill using the piling method noted above. The $7 million project consists of a 15,000-square-foot office building and adjoining 49,000-square-foot garage. The complex was built on the south side of the landfill where construction and demolition debris had been deposited. Early borings showed that the landfill was 20 to 25 feet deep and bedrock was encountered at 30 feet. The short distance to bedrock and the inert nature of the fill made this project feasible.

  To prepare the site, contractors leveled and compacted the rubble, using a crane to drop 20-ton weights from a height of 60 feet. The weights, dropped ten times in each location, formed a 20-foot grid of approximately ten-foot craters. Bulldozers then packed down two feet of gravel before an ironing compaction pass with wider weights further compressed the upper five feet. The foundation was set with 12-inch diameter concrete piles driven 30 feet down to bedrock.

  Constructing the public works complex on the landfill solved two major problems for the city of Albany. First, the cost of the new complex absorbed the $1 million required to close and cap the landfill. Second, the landfill site provided the necessary acreage and linkage[5] to the surrounding area. For years, the department of public works had maintained scattered office space requiring public vehicles to park all over the city. As part of its ongoing capital improvements, Albany sought a new state-of-the-art home for the public works department in an ideal location for service to the city.

When In The Life Of A Landfill Is The Best Time For Development?

The decomposition process within a landfill suggests that there is no "best time" to develop a landfill site. In general, landfill development should be postponed until the site has been completely capped and vegetation has grown. Good vegetative cover controls erosion and minimizes leachate by allowing the plants to utilize moisture on the landfill's surface through evapotranspiration. Vegetation also makes the completed landfill more visually compatible with the surrounding area.

The time to develop such a site depends on the type of development and the type of waste contained in the landfill. Parks and projects that can withstand settlement can pay less attention to timing than more complicated developments. Inert waste (fly ash, foundry sand and demolition debris) may begin soon after landfill closure because these landfills do not settle or generate methane. With municipal waste, however, timing of development is a more difficult issue.

In a municipal waste landfill, waste must undergo several stages of decomposition before methane is generated, creating a lag phase of about six months to two or three years. The duration of active gas generation appears to range from five years in warm, moist climates to 20 years in dry climates.[6] To be as safe as possible, a project should not be started until methane generation has ceased and the refuse is stable. However, these conditions are difficult to judge and may take several decades to occur.

Estimating Decomposition

Two methods may be used to estimate the state of decomposition in a landfill: gas pump tests and cellulose to lignin ratios. Together, these analyses determine how quickly a landfill can be developed for a particular end use.

The gas pump test measures changes in pressure in gas that has been pumped from a landfill to evaluate the potential of the refuse to produce methane or to determine how much more methane the refuse is expected to generate. Data from the pump test must be extrapolated into the future for interpretation, and they are subject to wide variability.

Refuse stability is determined by calculating the cellulose to lignin ratio of refuse samples collected from many different locations and depths in a landfill. Cellulose and lignin are specific organic materials that occur simultaneously in nature and are present in fresh refuse. Cellulose (in the form of paper and paper-related products) is the major chemically identifiable constituent of municipal refuse. Recently, data on the chemical composition of refuse have been published, and these data have been used in a mass balance analysis to calculate a methane potential for each chemical constituent. The results indicate that cellulose and its related hemicellulose fraction account for 91% of the methane potential.[7] Cellulose, therefore, can be expected to degrade during the decomposition process and convert to methane. Lignin does not degrade under the anaerobic (without free oxygen) conditions required for methane production; therefore, the ratio of cellulose to lignin changes with time as waste decomposition occurs. Studies that analyzed refuse samples from landfills across the United States revealed that the cellulose to lignin ratio decreased with time as the waste decomposed. The ratio was approximately 4.0 for fresh refuse, 0.9 to 1.2 for active and partially stabilized landfill and 0.2 for relatively well-stabilized landfill.[8]

A landfill site can be developed in stages that take into account the decomposition process and its associated side effects. The following example shows how this method may be used.

- Salt Meadows Park in Fairfield, Connecticut, is being constructed in stages on 300 acres that contain a wastewater treatment facility, two landfills, a public works garage and a refuse transfer station. The first stage of development involves constructing walking and bicycling paths (with gravel and stone dust) and picnic areas on the undulating terrain of one of the landfill sites. The next stage involves an outdoor amphitheater that will be terraced with fairly steep, gently sloping and somewhat level grassy areas. Years into the future when the

landfill becomes more stable, a stage, bandshell, dressing rooms, storage rooms and restrooms will be added to the amphitheater.[9]

What Architectural Issues Need To Be Addressed?

Any type of development on a landfill requires an architectural design that specifically addresses the characteristics and limitations of the site. Architectural designs must consider such issues as methane generation, settlement, water runoff and long-term care of the site.

Methane

Gases normally diffuse upward. However, since the landfill cover is relatively impermeable due to its high clay content, good compaction and possible wet or frozen conditions, gases travel laterally until they reach an escape location. To prevent methane from moving into structures built on a landfill site, gas barriers and gas channeling devices must be constructed. These gas protection measures may simply involve building a structure on a plastic liner that is positioned over a layer of gravel. Because gravel is permeable, it captures methane that is traveling toward the building. The plastic liner prevents methane in the gravel layer from seeping upward. Gas protection measures also may be quite sophisticated as is shown in the following example.

- The Albany Public Works Complex (mentioned previously) has a unique design for protecting against the release of methane gas. The 15,000-square-foot office area has been constructed over a four-foot crawl space plenum (a space in which the air pressure is greater than that of the outside atmosphere) for venting any methane gas that may escape from the landfill. Gas buildup in the plenum can be detected by manually checking gas detectors. More importantly, a methane concentration that reaches 20% of the gas' explosive limit sounds an alarm and triggers automatic aeration of the plenum to remove the methane within five minutes. Not since the building opened on June 8, 1990, or at any time before, has it been necessary to clear the plenum of gas.

  A three-fold system protects the 49,000-square-foot garage area of the complex. Under the garage's concrete floor is a layer of sand that covers a geotextile fabric (a non-woven PVC barrier layer). Below the fabric is a pipe system that collects methane from a one-foot layer of smooth, washed stones. Gas sensors in the layer of stones detect the concentration of methane, and they will sound an alarm if methane reaches 20% of its lower explosive limit. Positive pressure blowers or negative pressure suction then will evacuate the gas within 30 minutes. Beneath the stones is a PVC gas barrier membrane that can stretch 700% before it tears. The PVC layer prevents methane from moving upward. A ring of gas vents at the building's periphery vents any gas that moves laterally.[10]

Settlement

Landfill settlement is another issue that must be addressed in the architectural design of a development. Two foundation methods (piles and the use of virgin soil) for building structures, without waiting for settlement to cease, were described previously. If development can be postponed until the refuse has stabilized, floating foundations may be used. Also, because connections of utilities are subject to shearing from differential settlement, utility couplings must be flexible.

Water Runoff

Water that runs off buildings and parking lots constructed on a landfill should be collected and routed to the sewer system. If not collected and rerouted, the water will slowly seep through the landfill's cap and into the refuse to create excess leachate which is costly to treat and dispose and increases the potential for groundwater contamination.

Long-Term Care

Developments on landfills must be designed and constructed so as not to interfere with the long-term care operations of the site. Typically in the United States a landfill must be monitored and maintained for a 20- to 30-year period after closure. Long-term care involves monitoring groundwater, collecting and treating leachate, monitoring and controlling gas migration as long as necessary and maintaining the slope of and vegetation on the final cover. Development projects must be designed to allow access to particular areas of the landfill, such as leachate storage tanks, water monitoring wells and gas vents, so the long-term care of the landfill can be performed.

What Liability Comes With Owning Landfill Property?

Landfills are designed to accept certain types of refuse. A landfill may accept relatively inert material, such as fly ash or foundry sand, or it may accept only hazardous (or potentially hazardous) materials. Most landfills fall between these two extremes and receive normal community refuse. Today's modern landfills are engineered specifically for the types of waste they receive, and they are designed to minimize potential hazards to the surrounding environment. However, no matter how well-designed and operated, a landfill still may cause surface and subsurface contamination. Waste contained in a properly maintained landfill is not inherently hazardous but may become so under certain circumstances (e.g., excessive settling may cause leachate collection pipes to crack or break, allowing leachate to contaminate the area). If contamination occurs, some party will be held responsible for repair and cleanup costs. Two federal laws are most relevant to the potential liability involved with the investment in, operation on or development of a landfill site.

Resource Conservation And Recovery Act

The Resource Conservation and Recovery Act (RCRA), administered by the U.S. Environmental Protection Agency (USEPA), regulates the generation, transportation, storage and disposal of hazardous wastes. The purpose of this legislation is to protect

human beings from the dangers of illegal dumping of hazardous waste. The act applies primarily to businesses that deal with hazardous materials on a daily basis. Under this law, only landfills approved by the USEPA may be used for hazardous waste disposal.

Superfund

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), also known as Superfund, was enacted in 1980 (and revised in the Superfund Amendments and Reauthorization Act [SARA] of 1986) to provide funds that state governments and the USEPA can use, in emergency situations, to contain and cleanup hazardous waste contamination. The act authorizes the USEPA to impose cleanup (or remedial action) responsibility on property owners and/or operators. If the cleanup order is ignored, the USEPA can perform the cleanup itself and bill responsible parties for the cost. If cleanup is necessary and the responsible parties cannot be found or forced to do the cleanup at their own expense, the site is placed on the USEPA's National Priority List. Sites on this list are cleaned up in order as determined by the potential harm and human health risk they impose.

Three forms of liability for site remediation exist. Strict liability always exists and is imposed on any entity (e.g., person, partnership or corporation) related to the property as an owner, operator, transporter of or generator of hazardous material. The liability is imposed regardless of whether the entity knew of the problem or was even at fault. If more than one party is responsible, joint liability is imposed. The USEPA can require cleanup costs to be covered by any of the involved parties, including lenders. If a lender has participated in the operation of (or continues to operate after foreclosure) a property that is named by the USEPA, the lender will be a likely target for reimbursement of cleanup costs. This fact has caused many lenders to rethink commercial and industrial loan underwriting policies. Finally, liability is retroactive in that all previous owners and operators of a property may be held liable, even if the problem occurred before the enactment of CERCLA.

Exceptions to Superfund's strict liability are limited. The three exceptions (also known as the "Third Party Defense") are summarized as follows:

1. If the contamination was caused solely by an act of God or war.
2. If contamination "was caused solely by an act or omission of a third party other than an employee or agent of the new owner or other than one whose act or omission occurs in connection with a contractual relationship, existing directly or indirectly with the new owner."
3. If the new owner "establishes by a preponderance of the evidence that he exercised due care with respect to the hazardous substance concerned, taking into consideration the characteristics of such hazardous substance in light of all relevant facts and circumstances, and he took precautions against foreseeable acts or omissions of any such third party and the consequences that could foreseeably result from such acts or omissions."[11]

Given the limited legal defenses against liability, anyone contemplating the purchase or use of a landfill site must do everything possible to protect himself *before committing to anything.*

Suggestions For Risk Reduction

Risk has been defined as the difference between expectations and realizations.[12] Expectations are based on assumptions. The obvious method for reducing the risk of liability is to do everything within legal, financial and time limitations to "assume" as little as possible. In the case of landfill development, the site itself holds a set of specialized assumptions that must be confronted. Therefore, the first step is to learn as much as possible about the assumptions associated with a landfill site. The following is a list of suggested actions.

I. Research the site history.
   A. Who were the previous owners?
   B. What were the previous uses? Check to see if any previous use involved the generation, storage (including underground tanks) or disposal of hazardous material listed by the USEPA. If so, were all operations performed according to government regulations? Are there any records of contamination? If so, how was the situation remediated?

II. Find out if the property or surrounding property is (or may be) designated by USEPA or the state as a cleanup site.

III. Review landfill design and construction.
   A. Design.
      1. Who designed the landfill? What is their track record?
      2. Was the landfill designed according to regulations? Were any exceptions made for special conditions?
      3. What type of waste was the landfill designed to handle?
   B. Construction.
      1. Who constructed the landfill? What is their track record?
      2. Did the construction of the landfill follow the design? Were any design revisions necessary?

IV. Review the owner and management history of the site.
   A. Has the owner or manager been cited for any violations regarding the operation or safety of the landfill? For example:
      1. Groundwater contamination?
      2. Improper daily cover?
      3. Complaints about odors?
      4. Violations for accepting wastes other than those types approved for the site (e.g., a municipal landfill taking hazardous waste)?
   B. Are management practices well documented?

C. What is the owner's and the manager's track record? Have they owned or managed other landfills? If so, how have they performed in the past?

V. Determine long-term care responsibility: Who is currently maintaining the site? Will they continue to do so?

VI. Assess the fit of the project to:

A. Physical attributes: Is the site suitable for the development, considering such factors as size, shape, slope, topography, soil conditions and drainage characteristics?

B. Legal/political attributes: Is the property zoned for the intended use? If not, what is the potential for changing the zoning classification? Is there likely to be opposition to the proposed development?

C. Linkage attributes: Does the site have the necessary access and utilities?

D. Environmental attributes: How will the proposed project affect the landfill and the surrounding environment? For example, will excess weight disturb the cap? Will runoff from a parking lot overload the surrounding drainage systems?

E. Dynamic attributes (people's perception): How will the community respond to the proposed development? How will the intended market react to a landfill site?

VII. Hire a qualified environmental engineer to address the following issues:

A. Does contamination exist on (or near) the property in the soil, water or air?

B. If not, what is the potential for contamination from the landfill site and neighboring properties?

C. If so, what would be the cost of repair according to federal, state and local specifications?

As a final precaution, indemnification clauses, drafted by a lawyer familiar with environmental litigation, should be included in development contracts. Although indemnification clauses do not release owners and operators of the property from the strict liability mentioned above, these clauses can be enforced to recover the cost of cleanup.

What Does The Future Hold For Landfills And Their Subsequent Development?

The function of a landfill will change in the near future due to the practice of integrated waste management, which involves the coordinated use of waste reduction, recycling, treatment and disposal systems to minimize environmental impact and maximize resource utilization at a reasonable cost.[13] One result of integrated waste management is that a landfill will no longer be considered a final resting place for *all* material but a waste decomposition system.

Landfills will always be a necessary component of the integrated waste management system, because there always will be a residue that cannot be recycled, burned or composted. Estimates indicate that if waste were reduced by all possible methods, 50% of the landfill volume still would be needed.[14]

Up to this point, landfills have progressed from the old town dump to today's modern, sanitary landfills beause of reactions to environmental problems. It is anticipated that future landfill design will be proactive in nature. Research on refuse decomposition has revealed two principal methods for enhancing decomposition.

Leachate Recycling

Leachate recycling collects leachate from the base of a landfill and pumps it to the landfill's surface where it is injected into the cap. This method maintains a high moisture content throughout the landfill, increasing the rate of waste decomposition. It is expected that leachate recycling will greatly reduce the time necessary for complete decomposition of landfill waste. As a result, development of a landfill site may be possible in 10 to 15 years instead of 20 or 30 years.

Waste Segregation

Some types of waste are more conducive to degradation in a landfill than others. For this reason, future landfills may specialize in specific types of waste. One kind of landfill may contain inert matter, while another may be like a reactor in which "refuse is kept moist, allowed to decompose, and eventually is dug up and used as compost."[15]

While these enhancement methods have been used in laboratories, they have not yet been applied to full-scale landfills for long-term monitoring and direct evaluation of results. Strict government regulations and liability issues in the United States are impediments to testing and practicing these innovative concepts in landfill disposal. For this reason, Europe is far ahead of the United States in applying modern landfilling techniques and ideas. The lack of research and development funding from federal and state governments and private industry also has curtailed the trial of new ideas regarding decomposition enhancement. Current research and development efforts have improved past design problems, and more rigorous design standards have been developed. Still, future landfill designs (most likely from Europe) will treat landfills as reactors for quickly degrading refuse, promoting gas use, reducing environmental impacts and allowing for faster development of a completed landfill site.

Conclusion

As well-located, developable urban parcels become scarce, landfill sites grow more desirable. Problems associated with the development of landfill sites, such as market perception, lender uncertainty, government regulation and oversight and exposure to liability, are not insurmountable.

This article proposes that modern landfills are temporary land uses and that, following an appropriate period of utilization, redevelopment of a landfill site is not only possible but desirable. Technology is having a significant impact on the duration of the

temporary nature of a modern landfill. As the temporary use period is reduced (from 25 or 30 years to less than 10 years), the adaptive reuse considerations of a landfill site fall within the normative time horizons of most large-scale development plans.

With insight, care and craftsman-like diligence, a modern landfill site can be transformed from an underutilized mound of dirt and refuse to an economically efficient real estate asset that is beneficial to the consumer, the community and the developer.

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HOW A GARBAGE DUMP BECAME A POST OFFICE

A five-acre municipal dump proved to be an environmentally and economically responsible site for an air mail facilities building.

by John J. Wallace, CRE

The assignment: to acquire five acres of land for the U.S. Postal Service at Albuquerque International Airport. The problems: the only available site was filled with 40 feet and 30 years of accumulation of municipal garbage; the Postal Service was unwilling to assume liability for environmental contamination of unknown dimensions, nor to spend more for the use of the land than the worth of its surface rights. Although the assignment was seemingly impossible at the time, a major postal facility sits on that five-acre site today. Completion of this assignment may provide a model for cleaning up and reusing similarly polluted properties.

The Assignment

In early 1987, at the time of the Albuquerque assignment, our firm (Wallace & Steichen, Inc.) already had extensive experience with the Postal Service. This experience provided us with a detailed understanding of the Postal Service's site and facility requirements and acquisition procedures. We also had a strong working relationship with the staff of the Postal Service's real estate, facilities and environmental divisions. A close and trusting consultant-client relationship is important to the success of any consulting assignment, but it is crucial to the success of the really difficult jobs. We soon were to learn that this job would be a difficult one.

Air Mail Facilities

Air Mail Facilities, usually referred to in Postal Service lingo as AMFs, are located at major airports that serve an area through which all mail moving by air must pass. The Albuquerque AMF serves the entire state of New Mexico. Any mail in the air mail, first class, overnight, special delivery or priority categories that is sent to or from the state of New Mexico likely will pass through the Albuquerque AMF. Third and fourth class mail which travels by air on a space-available basis also may pass through this AMF.

AMFs have unique site requirements that are often difficult to meet. First, the site must be located within an airport's security fence to provide direct access to flight ramps so air cargo containers from airlines that have contracts with the Postal Service may be picked up and delivered directly.

Second, the site must possess direct vehicular access to public streets so that Postal Service vehicles can collect and distribute mail to major postal facilities throughout the state.

Third, the site must be relatively large; space must be allowed for adequate exterior secured paved

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areas for cargo and postal vehicle parking and maneuvering, an air cargo container storage area, unsecured employee parking areas and a one-story building of about 30,000 square feet.

Finally, an AMF must have vehicular access and parking to provide the retail postal customer with 24-hour service.

Albuquerque International Airport

At the time we accepted this assignment, the Albuquerque AMF was in desperate need of more space. Because of the lack of space, mailbags often were left outside on the airport tarmac, covered only with tarps when rainfall was imminent. The AMF was operating out of a 5,000-square-foot building on a 36,000-square-foot site. Our assignment was to identify and acquire a 220,000-square-foot site on which a 30,000-square-foot building could be built and later expanded to 45,000 square feet or more. To complicate matters, the airport was in the process of its own major expansion program. The existing AMF consequently was slated for demolition; already, giant earth moving equipment was operating within 50 feet of the AMF.

We discovered that the airport expansion plans made no provision or allowance for the Postal Service's needs. That the $120 million Albuquerque airport expansion program did not include space for a postal facility was not unusual. Increased need for airport land, caused by the rapid growth of air travel and restricted airport locations due to urban encroachment, have created tight space conditions at airports throughout the United States. In addition, airport planners often have placed the needs of commercial air carriers and air cargo companies ahead of the Postal Service's needs. The Postal Service does not own or operate its own planes, while United Parcel Service, Emery and Federal Express own and operate their own aircraft. Thus the Postal Service is in the unique position of needing access to airline ramp areas even though it does not operate aircraft.

Two other factors made site selection and acquisition difficult. The runways at Albuquerque International Airport are used jointly by commercial carriers and U.S. Air Force planes from Kirkland Air Force Base, an active, secured military establishment. It is not uncommon for takeoff of a commercial jetliner to be followed by the simultaneous takeoff of a pair of jet fighters. Because Kirkland Air Force Base controls about half of the airport property and adjacent land, many nearby sites were off-limits for all but military uses.

The airport is located on the western edge of a mesa. Steep drop-offs to the west and southwest made expansion difficult in these directions. Thus, site selection for a Postal Service AMF at Albuquerque Airport was hampered by urban growth, the presence of a secured military facility and natural topography.

The Assignment Changes

At my initial meeting with airport officials, I was told not only that there were no sites available for a new AMF but that within six months the Postal Service would have to vacate its existing AMF. This news was unexpected and serious in its implications on our work. Without the existing facility, no matter how inadequate it was, how could the Postal Service fulfill the needs of the residents of New Mexico? The news set off alarm bells at the Postal Service's Western Regional Headquarters in San Bruno, California, and changed our number-one priority from finding a site for a new AMF to keeping the existing facility in operation.

The Postal Service was leasing the land and building for the present AMF from a private real estate investor who had a master ground lease from the city of Albuquerque which owned the fee property rights. All terms and conditions of the land and building leases were reviewed with a fine-tooth comb, not only by our firm but by the Postal Service's real estate and legal staff at Western Regional Headquarters. The leases subsequently were sent to the legal staff at the Postal Service's national headquarters in Washington, DC. Review of the leases indicated that: (1) because the leases had no provision for early termination, the Postal Service had the right to use the existing AMF for another five years, (2) because the Postal Service had options to extend the lease for six additional five-year terms, it had the right to operate its AMF at the same location for almost 30 more years. Legal review also demonstrated that the city's eminent domain powers could not be used to take over land leased by a federal agency.

The Postal Service decided to affirm to the city of Albuquerque, in the most clear, direct and unequivocal terms possible, the following: (1) the validity of the Postal Service's lease and the lessor's master ground lease; (2) the Postal Service's intention to defend its leasehold interest through legal action at the highest levels, extending even to Washington, DC, if necessary; and (3) the Postal Service's intention to continue to operate at the existing location until a suitable new location was acquired.

I suggested that it might be wise for Postal Service employees to operate the existing facility 24 hours a day to ensure that the structure was not "mistakenly" demolished by an errant earth mover in the middle of the night. Although I offered this suggestion partly in jest, I was aware of more than one case in which demolition or destruction of real property improvements or natural amenities (trees, for example) rendered lease provisions, even with court protection, moot. If the AMF were mistakenly damaged or demolished, a lawsuit to recover monetary damages would drag on for years; in the meantime, the Postal Service would be without an operating AMF. I also knew that airport officials were motivated to assist the Postal Service in finding a site for a new facility in order to eliminate the existing one which put a monkey wrench in the airport's $120 million expansion plans.

A Search Goes Nowhere

The Postal Service's letter served its purpose; the city of Albuquerque agreed that the existing AMF would not have to be vacated. With the AMF now protected, our search for a permanent site shifted into high gear. Because we had virtually no suitable site leads, we decided to leave no stone unturned. In addition to airport officials, we contacted most of the owners of nearby property (even owners of property that did not have direct airport access) and tenants, including the commander of Kirkland Air Force Base.

We undertook investigations (legal, engineering, site planning, environmental, appraisal) of a number of properties that offered at least the prospect of being workable. However, each property possessed one or more major problems, and the most likely prospects conflicted with the airport's long range plans. Still, we persisted in an attempt to make at least one of these sites work. The Postal Service's legal staff in Washington, DC, even dusted off its condemnation powers, a right the Postal Service seldom threatened and had not invoked in at least a decade.

The Garbage Dump

It was during this period that airport officials first offered the site which our acquisition team thereafter referred to simply as the "Dump Site." I was introduced to the "Dump Site" as a passenger during an airport vehicle tour of potential site locations for the new AMF. My guide's brief description of the site fit the Postal Service's site criteria perfectly. However, the guide's description ended with the observation: ". . . Oh by the way, it's a fill site; previously, it was a garbage dump." As we approached the site, I suggested, in the most diplomatic way possible, that we not even stop or turn off the engine, because there was no chance in hell that the Postal Service would locate a post office on a garbage dump. I had worked with the Postal Service long enough to know how careful it was in accepting any site and how even the smallest toxic hazard or environmental blemish was reason enough to remove an otherwise excellent site from consideration. In this case, the potential for liability and constraints on building was enormous.

View of property prior to rehabilitation.

We soon learned that every bit of the more than five-acre "Dump Site" had been filled with garbage, in some spots up to 40-feet deep, and the site had been covered with a thin layer of noncompacted fill. The site was generating significant quantities of methane gas that was migrating beyond the landfill's boundaries. Natural soils below the landfill had been contaminated. The surface of the site looked like a moonscape; its topography varied because of uneven settling of the noncompacted fill. Foot-wide pipes, for draining off methane gas, shot six feet up from the ground throughout the site. In its current state, the site was unable to support any building foundations. Its highest and best use seemed to be its current use: as an exterior storage area for construction materials and a rough parking area for the construction workers who were involved in the airport expansion.

It was widely known that the site had been used as a municipal garbage dump for the city of Albuquerque from the early 1940s through the 1960s. Given the absence of environmental controls and adequate methods of disposal of toxic materials during that period, we feared there was much more than municipal garbage on the site, even though recent soil tests confirmed the nonindustrial nature of the fill.

Our wildest, though unfounded, fears centered on the possibility of radioactive contamination of the site because of its proximity to the areas in which the first atomic weapons were developed and tested. Los Alamos is located 60 miles north of the site. During the late 1940s and 1950s, Kirkland Air Force Base was home to the Armed Forces Special Weapons Command and an atomic test squadron that took part in the 12 nuclear test series conducted in Nevada and the Pacific. In addition, nuclear weapons research laboratories located in and around Albuquerque assisted in the atomic weapons programs. With this information as background, I told airport officials that hell would freeze over before the Postal Service would accept this site, even if it was provided free of charge.

What It Takes To Make An Unusable Site Usable?

Airport officials did not back off this site as I had hoped, and soon were pushing it even harder. I was frustrated. I knew at the time that it would be foolish for the Postal Service to accept the site. It was my opinion that the city of Albuquerque was trying to pass off on Uncle Sam not only an unusable site but an enormous potential liability as well.

To convince airport officials that the site had been diligently and thoroughly considered, the Postal Service set into writing the precise conditions under which it would accept the site. We did not expect

these demands to be met but thought that by stating these requirements the site could be totally and completely eliminated as an alternative. The two most important conditions were: (1) the airport would remove all landfill material from the site and refill and rehabilitate the site with fill that met U.S. Environmental Protection Agency and Postal Service environmental and engineering standards; and (2) the site would be ground leased to the Postal Service for 40 years at fair market rental value.

These conditions, which were fair and logical from the Postal Service's perspective, were like asking for Albuquerque's first born in terms of their economic implications. Fair market ground lease annual rental was estimated to be $0.50 per square foot of surface area based on a 10% return on an estimated land value of $5.00 per square foot. However, for every surface foot of land, there were up to 40 cubic feet of garbage, fill or contaminated soil that had to be removed and replaced with clean fill. The cost of removing the fill, rehabilitating the site and relocating and extending utilities and roads to the site was expected to cost more than the property's land value and 10 to 20 times the annual rental revenue. Thus, the airport would receive at best a below market return on the site preparation costs and no return on the land.[1]

You've Got To Be Kidding!

Astoundingly, within a few weeks airport officials agreed to meet the Postal Service's requirements, with only minor clarifications and modifications. Our initial reactions included both surprise and cynicism. We knew there had to be a Trojan horse somewhere in the city's offer. We never found it.

Negotiations were concluded in early 1988: The rent was set at $116,000 annually for 20 years (based on a 10% return on $5.20/per square foot of land value). An option extended the lease for an additional 20 years with the rent adjusted on the basis of a reappraisal of the property.

Over the next two years, an estimated 150,000 cubic yards of fill were removed. A plastic polyvinyl chloride liner was placed on the bottom and sides of the excavation to protect against the migration of methane gas from surrounding dump properties. The site was re-engineered with clean fill and delivered to the Postal Service in buildable condition in late summer, 1990. The Postal Service completed construction of its building in May, 1991 and moved into its new AMF in June, 1991. Ultimately, the cost to the airport exceeded $1.4 million for a site with an appraised market value of about $1.1 million.

Photograph of the site being compacted with clean fill. Polyvinyl chloride liner can be seen around the edges of the site.

Why Spend More To Rehabilitate A Site Than The Site Is Worth?

Although my client acquired a suitable site at fair market value under very difficult conditions, I was puzzled by the outcome. I was bothered by the seemingly uneconomic terms airport officials ultimately accepted. Throughout my career, I have advocated reaching fair deals in which both parties win. I wondered if the Postal Service's ability to block the airport expansion was the ultimate reason for the officials' decision, or if other factors also were at work.

Although still unsure of airport officials' motivation, I have concluded that they acted in an environmentally responsible and economically logical manner. I base my conclusion on the following two guidelines:

1. A particular piece of real property should not always have to bear the full burden of cleaning up environmental pollution even though that pollution is located entirely within the boundaries of the property.

A regional airport of necessity must include many elements and uses, including runways, passenger terminals, air cargo facilities, aircraft service facilities, public parking, etc. An AMF is just one element that must be accommodated at a regional airport such as Albuquerque International. In this case, the airport had insufficient land to accommodate all its necessary uses unless it reclaimed some of the "Dump Site." Responsibility for reclamation of the "Dump Site" rested with the airport, not with the tenant who ultimately leased the site. The cost of the dump site cleanup might therefore be considered as a capital cost that should be spread over the entire airport property. Thus, the cleanup cost of $6.36/per square foot (1.4 million ÷ 220,000 square feet) for the five-acre site is reduced to $0.016 per square foot when spread over the entire 2,000-acre airport property.

This conclusion may be extended to any real estate project, either new development or redevelopment. Today, some portion of many large properties on which development has been proposed has been polluted and must be cleaned up. Unless the cleanup is considered to be a capital cost of the entire project,

View of rear of the new air mail facilities building at Albuquerque International Airport in the weeks before occupancy.

development of these properties would seem to be prohibitively expensive and economically unfeasible.

2. The entity reponsible for the pollution and those who may have benefited from a dump site should be responsible for the cost of the cleanup.

The city of Albuquerque did nothing illegal, unethical, immoral or anti-environmental by operating a municipal dump at the site over a 30-year period. For health and safety reasons, a solid waste dump was necessary to accommodate the needs of the residents and businesses of the city. The location of the dump on this site was appropriate.

However, the city owned and operated the dump. Albuquerque International Airport, a department of the city, managed the dump property for two decades. The residents and taxpayers of Albuquerque benefited from the dump. All fingers, therefore, pointed to the city of Albuquerque as the entity responsible for the pollution and the entity that benefited from the dump site. (Determining environmental responsibility is far more difficult when the polluters have long since disappeared and the property has changed hands.)

Conclusion

We did not plan this outcome; we tripped over it. Yet the outcome proved better than we had envisioned. The Postal Service has a new facility; the airport met its mission in an economically logical manner; and in the process a dump site has been cleaned up.

Prior to the conclusion of this assignment, I, like most of my real estate colleagues, would have automatically eliminated from consideration any property that had potentially significant environmental pollution or liability. We should not do this.

A property's environmental pollution or liability problems should be evaluated as any other cost factor that affects the parcel's use or value. This evaluation should involve: (1) a detailed assessment of the pollution by an experienced engineering or environmental expert; (2) a determination of the cost of remedying the situation; (3) a determination of the property owner's exposure to continuing pollution liability, if any; and (4) identification of others who may help to offset the cost of the cleanup (e.g., sellers, past users or local governments that may provide more generous zoning of a particularly obnoxious property in need of cleanup). Only after all this information is compiled should real estate professionals proceed with the economic analysis for the property's acquisition or development.

NOTE

1. A shortage of land did not raise the price of the land (or the rent) until demand and supply for the land were in equilibrium. Because the airport holds a monopoly position on property with airport access and because it acts as a public service, the airport sets rent levels and land prices based on an analysis of similar industrial properties in the extended market area located outside of the airport.

THE EFFECTS ON RESIDENTIAL REAL ESTATE PRICES FROM PROXIMITY TO PROPERTIES CONTAMINATED WITH RADIOACTIVE MATERIALS

A case study of three Superfund sites in New Jersey and how they were affected by single-family residential property sales prices.

by William N. Kinnard, Jr., CRE, and Mary Beth Geckler

On December 1, 1983, the U.S. Environmental Protection Agency (USEPA) and the New Jersey Department of Environmental Protection (NJDEP) jointly announced that concentrations of radon gas and levels of onsite gamma radiation were well above regulatory standards in three residential neighborhoods in three adjacent towns in northern New Jersey. The elevated levels of radon and gamma radiation resulted from the presence of radium-contaminated fill material on many lots in the neighborhoods.

The three neighborhoods were placed on the National Priorities List and included in the Superfund program in October, 1984. These three Superfund Site Areas (SSAs) are referred to in this article as Towns A, B and C.

Extensive remediation programs were initiated promptly in Towns A and C; these programs were completed during 1985. In Town B, on the other hand, a program to excavate contaminated fill material (and later to replace the material with clean fill) was only partially completed before it was abandoned in September, 1985. Because a disposal site was not available, NJDEP was forced to place the excavated fill material in sealed drums, which were stored openly on the lawns of vacated houses.

The initial announcement of the elevated radon and gamma radiation on the sites received widespread publicity in both print and electronic media. There also was continuous, daily publicity about the open storage of the contaminated fill material. Danger! Radiation signs and radiation warning symbols were displayed on a fence surrounding the sites on which the drums were stored. The drums of contaminated materials were removed in September, 1987, which also generated considerable publicity, and they eventually were shipped out of state. Not until June, 1990, was a USEPA remediation program approved.

Property owners seeking to sell or lease properties within the three SSAs were required by state law to reveal the most recent radon readings (if any) to any potential buyer or tenant.

The Research Assignment

In October, 1989, the Real Estate Counseling Group of Connecticut, Inc., (RECGC) was retained to conduct a market research study of all single-family residential property sales within the three SSAs. In

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addition, RECGC was asked to study all residential property sales within a larger study area that extended one mile beyond the outer limits of each SSA.

The study period extended from July 1, 1980, through June 30, 1989, and it included 67 months of post-announcement sales experience. The analysis identified, reported and measured the actual market sales behavior of buyers and sellers. Both the impact on sales prices and the changes in the volume of sales transactions were analyzed.

Questions To Be Addressed

Statistical tests were conducted on the assembled residential property sales transaction data to answer the following questions:

- What was the pattern of inflation-adjusted sales prices per square foot of single-family residences in each town, within each SSA and within selected distance zones up to one mile from the SSA? What was the pattern in the 41 months preceding the public announcement of the existence of radioactive contamination within the SSAs? What was the pattern in the 67 months that followed the announcement?
- What changes in levels of inflation-adjusted sales prices per square foot of living area were identifiable and measurable after the announcement? How did these prices compare with levels of inflation-adjusted unit sales prices before the announcement?
- What patterns of sales volumes of single-family residential properties were observed during the 41 months before the announcement and over the 67 months afterward? What changes in those patterns occurred before and after the announcement?
- How far distant from the outer boundary of an SSA did a residential sales property have to be before there was no measurable negative impact on the inflation-adjusted sales price per square foot of living area or on the volume of sales associated with proximity to the SSA?

Research Project Design

Analytical Models

Three categories of analytical, statistical models were utilized. They provided comparisons of inflation-adjusted price levels and of rates of change in those price levels for single-family properties at varying distances from the three SSAs before and after January 1, 1984. They also provided comparisons of sales volumes within the study areas.

- *Comparison Of Averages.* Arithmetic means of inflation-adjusted prices were calculated and compared by year for each distance zone.
- *Trends.* Percentage changes in levels of inflation-adjusted prices and in volume of sales were calculated and compared.
- *Multiple Regression.* Sales data were assembled into four data sets: one for each of the three towns and one for the combined total. Dependent and independent variables were entered into regression models in the standard Hedonic Pricing Model format to test the influence and statistical significance of time, location (distance from an SSA) and property characteristics on the inflation-adjusted sales price per square foot of living area. Multiple Linear Regression Analysis (MRA) often is used to identify, measure and evaluate the influence, relative importance and statistical significance of all property, transaction and location characteristics that influence sales prices. In this study, it was used to isolate, measure and test the significance of both distance from an SSA by zone *and* the likely effects of post-announcement awareness of radon gas and gamma radiation concentrations within the SSAs.

Data Requirements

Certain categories of information were required to apply the analytical models.

- *Sales Price Data.* Every transaction had to have a recorded sales price to be used in the study. Sales prices were deflated to December, 1983, dollars through the use of the All Urban Households Consumer Price Index. The result of this deflation was the adjusted sales price (ADJSP). Because *size* (square feet of living area) is one of the most important determinants of sales price, the ADJSP was refined to incorporate square

FIGURE 1

List of Variables for Multiple Regression Analysis

Dependent Variables	
Inflation-adjusted sales price per square foot	(ADJSPSF)
Independent Variables	
Deed date (year, month)	(DDATE)
After January 1984 (Yes-No)	(BEFAFT)
Square feet of living area	(SFLIVARE)
Square feet of lot area	(LOTSIZE)
Age in years at time of sale	(AGE)
Number of stories of residence	(#Stories)
Shingle/wood siding (Yes-No)	(SHINGLES)
Brick exterior finish (Yes-No)	(BRICK)
Stucco exterior finish (Yes-No)	(STUCCO)
Stone exterior finish (Yes-No)	(STONE)
Number of garage/carport stalls	(GARSTALS)
Attached garage (Yes-No)	(ATTACHED)
Detached garage (Yes-No)	(DETACHED)
Carport (Yes-No)	(CARPORT)
Basement garage (Yes-No)	(BASE GAR)
Within Zone A (Yes-No)	(A ZONE)
Within Zone B (Yes-No)	(B ZONE)
Within Zone C (Yes-No)	(C ZONE)
Within Zone D (Yes-No)	(D ZONE)
Within Zone E (Yes-No)	(E ZONE)
Within Zone F (Yes-No)	(F ZONE)
Within Superfund site (Yes-No)	(S ZONE)

footage. The adjusted sales price per square foot (ADJSPSF) was the dependent variable used in this study.

- *Time.* The date of sale was recorded for every sales transaction by year and month. Two measures of time and its possible influence on ADJSP or ADJSPSF were employed. The first was the date of the deed (DDATE), which indicated the year and month of the execution. The second measure of time (BEFAFT) indicated whether the deed was recorded *before* or *after* January 1, 1984. For the purposes of this study, any deed recorded during December, 1983, was excluded because it did not represent a sale that was affected by the announcement.
- *Property Characteristics.* All properties in the study were single-family residences. Two of the most important influences on the sales prices of residential properties are size (square feet of living area) and age (in years) at the time of sale. Data on size and age therefore were gathered on all sales transactions. Any sales transaction for which either the size or the age of the residence could not be obtained from an official source was excluded from further analysis.

Because it was not possible to identify retroactively the condition of the property at the time of sale, age at the time of sale served as a proxy for the condition of the property. In addition, data on lot size, type of garage, number of parking stalls, number of stories of residence and exterior finish were obtained. Data were not available on the number of rooms, number of bedrooms or number of bathrooms.

- *Location: Distance From The Superfund Site Area.* The focus of the research project was to ascertain any impact from or effect of proximity to the SSAs on sales prices (adjusted for inflation and size). Therefore, particular attention was paid to the location and distance from an SSA for each sales transaction property. The measure of distance was obtained by identifying the distance zone in which each sales property was located.

Data Collection And Data Recording

Data Sources. Listings of all property sales coded as residential were obtained for each fiscal year (July 1–June 30) from 1980-81 through 1988-89. These data came from SR1A forms on which local assessors report all bona fide, arm's-length real estate sales transactions for the year.

Additional information came from Real Estate Data Incorporated (REDI). This subscription service summarizes sales transaction data within communities in northern New Jersey quarterly and monthly. REDI listings provided the street addresses of most sales properties, which were correlated with the block and lot number provided in the SR1A summaries.

The major source of information was assessor's property cards for each of the three townships. The property cards frequently provided corroboration of data obtained from other sources as well. If critical information was missing from the assessor's property cards and could not be obtained from other sources, the property was not included in the data base.

Finally, visual inspections of the exterior of all sales properties were conducted to check and verify (or correct, as necessary) the information obtained from REDI and the assessor's property cards.

Mapping And Distance Zone Identification. The distance of each sales transaction property from the pertinent Superfund site in its town had to be identified. Since the Town B Superfund site extends into Town C, some properties that are relatively distant from the Town C Superfund site are actually relatively close to the Town B Superfund site.

To identify distance from or proximity to each SSA, distance zones were established. (The zone definitions are summarized in Table 1) Every sales transaction property was mapped, and its zone location was recorded.

Data Screening And Usable Data Sets.
A total of 2,317 sales were identified from the SR1A forms as likely candidates for analysis. It was necessary, however, to eliminate those sales transactions and properties that did not meet the eligibility standards of the research study.

First, a complete data file was necessary for the sales transaction to be included in the study. Any file without data on square feet of living area, date of construction of the dwelling (to provide age at the time of sale) or the number of families (only single-family residential property sales were usable) had to be eliminated. Table 2 shows that 88 sales transactions were eliminated because of unavailable record data.

Ninety-eight sales were eliminated because more precise measurement on large-scale maps revealed that they were located more than one mile from an SSA. One sale that occurred prior to July 1, 1980, also was eliminated.

TABLE 1

Identification of Distance Zones

Zone	Distance from SSA*
S	Inside SSA
A	1–250 feet
B	251–500 feet
C	501–1000 feet
D	1001–1500 feet
E	1501–2500 feet
F	2501–3500 feet
G (Control area)	3501–5280 feet

**Distance from the SSA is the linear distance of the nearest portion of the sales transaction property to the outer boundary of the closest SSA.*

TABLE 2

Summary of Sales Data Screening Process (by Town, by Reason)

	Town A	Town B	Town C	Total
Total unscreened sales	541	831	945	2317
Less: Outside limits of property characteristic parameters				
Located beyond 1 mile	15	13	70	98
Bought before 7/1/80	0	1	0	1
More than 5,500 square feet	4	28	5	37
Not a single-family dwelling	7	316	347	668
Subtotal: Outside limits	26	358	422	804
Balance	515	473	523	1513
Less: Record data missing				
Square foot of living area	21	23	27	71
Year built	7	0	8	15
Number of families	0	1	1	2
Subtotal: Data missing	28	24	36	88
Screened, usable sales	487	449	487	1425

The SR1A reports include both one-family and two-family properties in the "2" property coding for sales transactions. As Table 2 shows, 668 two-family (or other non-one-family) sales had to be removed.

Finally, no property was included in the final data set if one of three major characteristics was outside the 99% confidence interval around the mean for that characteristic: square feet of living area, age at the time of sale, and lot size. This eliminated another 37 sales as non-representative outliers.

Table 2 shows that the final total usable data set for all three towns contained 1,425 sales. The sales were almost evenly divided among the three towns, with 487 usable sales in both Towns A and C and 449 sales in Town B.

Variables For Multiple Regression Analysis. MRA requires the identification of both a dependent variable and the independent variables that will be used in the analysis. The dependent variable used in this study was inflation-adjusted sales price per square foot of living area (ADJSPSF). In each MRA run, only one time variable was used: either the date of deed (DDATE) or before-after January 1, 1984 (BEFAFT). Figure 1 identifies, explains and lists the dependent variable and independent variables that were used in the MRA models.

Research Findings

Average Property Characteristics

Average of property and transaction characteristic values provided a basis for comparison as well as indications of what is typical or representative of the market.

Inflation-Adjusted Sales Price (ADJSP). The average ADJSP in each zone for each year was compared within the three-town usable sales data set and the data set for each town. A notably consistent pattern of findings emerged. First, during the years 1980-83 (before the announcement), the average ADJSP in Zones S (the SSAs), A and B was typically *lower* than the average ADJSP in more distant zones. Some exceptions were found in Zone B. Although there was no absolute decrease in average ADJSP, rates of increase in Zones S, A and B were lower than those in the other zones after 1984. ADJSP in general was lower in 1989, regardless of zone.

Size Of Dwelling (Square Feet Of Living Area). In the three-town total, the houses in Zones S, A and B were typically smaller than those in other zones both before and after January 1, 1984. In Town A, the smallest houses were in Zones S, A and B. In Town B, the houses in Zones S and A also averaged the smallest. In Town C as well, the houses in Zones S, A and B were well below average in size. Part of the explanation for lower average ADJSP in Zones S, A and B is the smaller (below-average) size of houses in those zones in each of the three towns. This was true both before and after the December, 1983, announcement.

Age Of Dwelling At The Time Of Sale. The study areas in the three towns tended to be concentrated in older neighborhoods. The average age of dwellings at the time of sale for the 1,423 total usable sales was 64 years. The *lowest* average age of dwelling at time of sale was in Zones S and A.

The same general pattern of average age distributions appeared in each of the three towns. Generally, the houses in Zones S, A and B averaged 60 years old or less. Average ages tended to increase for houses that were more distant from a Superfund site. The one exception was in Town C, where the lowest average ages at the time of sale were in Zones F and G. However, age of dwelling at the time of

sale did not help explain the generally lower average ADJSP in Zones S, A and B.

Lot Size (Square Feet Of Land Area). The average lot size for the three-town data set was 10,700 square feet. Throughout each of the three towns and in the three-town total, lot sizes in Zones S, A and B were consistently smaller on average; the smallest average sizes usually were in Zone S.

Therefore, in Zones S, A and B (especially Zone S), average house sizes were smallest, and these smaller houses were located on smaller lots. The combination of smaller houses on smaller lots helped to explain in part the lower average ADJSP found in Zones S, A and B both before and after the December, 1983, announcement.

These observable and measurable size and age differences suggested strongly that simple comparisons of averages by zone over time probably would fail to capture enough of the influence of proximity to an SSA on ADJSP. That is why comparisons of averages and of trends were supplemented with multiple regression analysis.

Sales Volume (Number Of Sales). One indicator of changing market conditions is a change in the number of sales that occurs in a given area or zone over a specified time period. This reflects changing buyer attitudes toward owning and living in that location. One important way for potential buyers to react negatively to a given market situation is to withdraw from the market and refrain from purchasing.

The sales data in the study showed an overall decline in residential real estate market activity in all three towns (and in the county) after 1985. This is the context within which sales volumes in the three study areas were examined and analyzed.

There was an across-the-board decrease in residential property sales volume after 1985, but there was no perceptible or measurable decrease in sales volume in 1984 and 1985, the two years immediately following the December, 1983, announcement. This suggested that there was no negative reaction to residential property purchase in the three-town total. Moreover, sales volume actually increased in Zones A and B in 1984 and 1985. There was a very modest decline in sales in Zone S in 1984, but sales recovered again in 1985. In 1989, sales volumes in Zones S, A and B declined more than in the more distant zones.

Buyer reactions to proximity to the three SSAs apparently varied considerably from one town (and SSA) to another. Proximity to the Town B SSA appeared to be more of a deterrent to would-be buyers than was proximity to the SSA in either Town A or Town C.

Inflation-Adjusted Sales Prices Per Square Foot Of Living Area. Table 3 shows average inflation-adjusted sales price per square foot of living area (ADJSPSF) by zone and by year for each town studied and for the three-town total data set.

For the three-town total, levels and trends of average ADJSPSF in Zones A through D were roughly similar. Averages were higher in Zone E, especially in 1988 and 1989. The average for Zone S followed essentially the same pattern as that for every zone except E.

In the individual towns, there was considerably more variation in average ADJSPSF by zone from year to year. There also were gaps for those zones in which no sales occurred during the given years.

The total pattern of levels and variations in average ADJSPSF by zone suggested that some measurable negative impact probably occurred in Zones S, A and B in Town B and possibly in Town C; no such negative impact occurred in Town A.

Before-After Changes

Comparisons of average ADJSPSF and of sales volume by zone and by town before and after January 1, 1984, helped to clarify whether any discernible negative impact on average ADJSPSF or sales volume was evident after the announcement. (The results of these comparisons are presented in Tables 4, 5 and 6.)

Average ADJSPSF By Zone, Before And After January 1, 1984. Table 4 shows the percentage changes in average ADJSPSF by zone.

For the three-town total set of usable sales, Zone A exhibited the lowest percentage increase, suggesting some possible negative impact. The percentage increase in average ADJSPSF for Zone S was approximately equal to the average for all study areas.

Virtually the same pattern in average ADJSPSF by zone was exhibited in Towns A and B. In Town C, on the other hand, the percentage increase after January 1, 1984, was lowest in Zone S. This finding indicated a possible further negative impact.

Number Of Sales By Zone, Before And After January 1, 1984. A different pattern was shown for changes in sales volume (Table 5). For the three-town total, the smallest percentage increase was found in Zone S. The largest percentage increase in sale volume occurred in Zone A, and the third highest percentage increase occurred in Zone B.

A spotty pattern of percentage increase in sales volume by zone appeared when before and after sales volumes were compared from town to town. This pattern suggested that any negative market response was confined to the SSAs themselves.

Percentage Distribution Of Number Of Sales, By Zone And By Year. Table 6 expresses the number of sales in each zone as a percentage of total sales for that year.

For the three-town total, no consistent pattern of relative change emerged among the zones closest to the SSAs. That inconsistency became even more evident when data for the individual towns were considered. There was substantial variation over time by zone from town to town. Moreover, the evidence suggested a short-term (1984–1985) avoidance of

TABLE 3

Average Inflation-Adjusted Sales Price per Square Foot (by Year, by Zone)

				Three-Town Total Zone					
Year	S	A	B	C	D	E	F	G	All
1980	$ 48.66	$ 55.30	$ 37.15	$ 54.04	$ 45.83	$ 41.49	$ 48.15	$ 39.37	$ 45.90
1981	52.78	57.58	48.59	49.68	45.47	45.19	40.36	39.99	46.38
1982	49.40	45.88	49.80	43.37	36.65	48.91	44.74	53.64	47.64
1983	50.27	54.56	47.81	53.39	43.74	57.31	47.18	42.46	48.94
1984	56.53	57.87	61.85	61.20	51.86	55.32	62.12	54.22	56.89
1985	71.25	66.75	72.02	66.75	68.60	64.86	68.97	63.40	67.31
1986	90.25	92.25	87.55	97.49	85.81	89.99	81.60	78.98	87.59
1987	102.50	103.87	103.29	94.97	97.93	101.43	94.06	104.57	100.37
1988	112.75	100.81	106.19	106.90	112.54	116.73	98.92	101.41	107.71
1989	97.50	92.42	90.49	103.25	100.32	129.34	101.77	98.12	104.39
All	74.34	76.43	74.38	76.29	74.77	72.92	68.00	66.99	72.24

				Town A					
Year	S	A	B	C	D	E	F	G	All
1980	$ 52.31	$ 63.79	$ 48.01	$ 65.80	$ 51.75	$ 39.68	$ 43.57	$ 46.78	$ 51.42
1981	55.89	61.49	49.19		45.02	55.64	42.73	45.60	52.79
1982	53.97	57.35	64.17	38.25	45.08	53.38	47.87		53.42
1983	54.68	59.35	65.97	63.87	55.78	79.66	49.46	50.53	56.74
1984	61.89	76.74	62.89	132.60	55.29	63.78	61.00	52.44	62.88
1985	81.47	80.23	90.10	66.26	82.89	80.05	79.86	65.59	78.62
1986	103.65	109.48	123.57	102.00	104.47	97.28	102.05	83.83	101.37
1987	104.71	122.80	158.01	108.46	113.99	109.06	101.02	103.02	108.30
1988	116.49	110.61	115.97	114.13	117.50	126.36	99.69	95.72	112.06
1989	108.79		107.37	87.36		108.08	92.81	119.30	106.02
All	81.09	87.48	89.21	86.55	82.18	82.15	72.78	70.39	80.14

				Town B Zone					
Year	S	A	B	C	D	E	F	G	All
1980	$ 22.99	$ 62.83		$ 45.86	$ 30.64	$ 41.61	$ 40.31	$ 37.49	$ 41.13
1981	35.36			23.58	47.81	39.70	43.70	30.21	38.87
1982	40.36	37.16	$ 40.23	43.38	43.56	50.75	44.67	54.60	47.85
1983	37.05	39.21	50.46	48.14	38.00	46.16	45.51	39.85	42.17
1984	45.08	47.20	48.87	44.78	48.87	51.79	62.71	46.38	51.35
1985	55.09	46.57	62.07	75.97	47.61	54.79	61.18	65.44	59.64
1986	61.77	79.56	78.73	96.04	80.42	91.14	69.84	65.82	78.54
1987	87.42	82.32	126.54	83.41	70.49	97.67	82.79	89.91	88.17
1988	84.85	91.84			86.54	81.61	96.97	99.12	92.66
1989			59.06	124.95	58.19	136.38	108.23	100.74	106.46
All	52.68	62.77	63.63	68.84	58.66	64.89	64.23	59.71	62.18

				Town C Zone					
Year	S	A	B	C	D	E	F	G	All
1980	$ 46.28	$ 35.05	$ 35.34	$ 50.46	$ 47.69	$ 45.99	$ 60.56	$ 32.09	$ 44.74
1981	58.67	38.02	48.41	54.03	40.27	41.38	31.31	44.17	44.99
1982	48.59	47.86		44.64	33.58	40.57	44.20	50.76	44.22
1983	45.86	56.51	43.65	46.85	36.89	40.41	20.13	24.65	42.06
1984	51.48	46.37	67.64	50.21	50.32	47.78	63.29	62.61	55.29
1985	64.33	57.46	70.41	60.51	66.62	64.07	66.68	56.92	63.58
1986	76.12	83.17	82.22	95.00	84.07	79.81	74.94	88.92	83.39
1987	104.80	95.28	92.15	90.57	94.16	98.27	105.43	116.23	100.25
1988	98.67	93.85	100.60	104.19	115.19	122.50	104.80	108.89	109.36
1989	86.21	92.42	92.92	99.32	142.44	136.49	78.44	75.73	101.88
All	69.63	70.09	72.34	75.24	79.34	73.55	67.98	76.15	73.63

TABLE 4

Inflation-Adjusted Sales Prices per Square Foot (by Zone) Before 1/84 and After 12/83

Three-Town Total (1,423 Sales)									
	Zone								
Time	S	A	B	C	D	E	F	G	All
Before	$ 50.41	$ 53.53	$ 45.75	$ 50.21	$ 43.25	$ 48.87	$ 45.48	$ 44.10	$ 47.45
After	86.91	82.91	84.79	89.49	85.57	83.32	79.35	77.66	83.09
Percent Change	+72	+55	+85	+78	+98	+70	+74	+76	+75
Town A (487 Sales)									
	Zone								
Time	S	A	B	C	D	E	F	G	All
Before	$ 54.45	$ 60.82	$ 56.78	$ 61.67	$ 50.55	$ 60.94	$ 47.64	$ 48.18	$ 54.36
After	96.18	97.23	101.37	97.21	93.13	89.97	86.16	79.76	91.73
Percent Change	+77	+60	+79	+58	+84	+48	+81	+66	+69
Town B (449 Sales)									
	Zone								
Time	S	A	B	C	D	E	F	G	All
Before	$ 36.28	$ 46.40	$ 42.79	$ 44.14	$ 41.64	$ 46.04	$ 44.09	$ 42.74	$ 43.41
After	64.26	68.54	69.58	89.43	68.28	76.21	74.13	71.33	73.19
Percent Change	+77	+48	+63	+103	+64	+66	+68	+67	+69
Town C (487 Sales)									
	Zone								
Time	S	A	B	C	D	E	F	G	All
Before	$ 48.95	$ 44.03	$ 42.73	$ 49.50	$ 40.05	$ 41.31	$ 44.42	$ 43.40	$ 44.24
After	77.05	74.53	83.68	85.65	89.16	84.12	79.28	83.79	82.82
Percent Change	+57	+69	+96	+73	+123	+104	+78	+93	+87

TABLE 5

Number of Usable Sales (by Zone) Before 1/84 and After 12/83

Three-Town Total									
	Zone								
Time	S	A	B	C	D	E	F	G	All
Before	73	28	28	41	36	77	67	83	433
After	139	99	77	81	105	178	133	178	990
Percent Change	+36	+253	+175	+98	+192	+131	+99	+115	+129
Town A									
	Zone								
Time	S	A	B	C	D	E	F	G	All
Before	47	15	6	9	9	21	25	19	151
After	83	41	16	21	26	57	47	45	336
Percent Change	+77	+173	+167	+133	+189	+171	+88	+137	+123
Town B									
	Zone								
Time	S	A	B	C	D	E	F	G	All
Before	12	6	4	15	13	36	30	50	166
After	17	17	14	18	23	60	61	73	283
Percent Change	+42	+183	+250	+20	+77	+67	+103	+46	+70
Town C									
	Zone								
Time	S	A	B	C	D	E	F	G	All
Before	14	7	18	17	14	20	12	14	116
After	39	41	47	42	56	61	25	60	371
Percent Change	+179	+486	+161	+147	+300	+205	+108	+328	+220

TABLE 6

Number of Sales as a Percentage of Each Year's Total (by Zone)

	Three-Town Total Zone								
Year	S	A	B	C	D	E	F	G	All
1980	16.25%	8.75%	8.75%	11.25%	8.75%	13.75%	15.00%	17.50%	100.00%
1981	17.31	5.77	8.65	6.73	9.62	23.08	11.54	17.31	100.00
1982	15.24	5.71	4.76	10.48	6.67	20.95	17.14	19.05	100.00
1983	18.06	6.25	4.86	9.72	8.33	13.89	17.36	21.53	100.00
1984	12.43	8.65	7.03	3.78	5.95	23.24	14.59	24.32	100.00
1985	12.39	11.50	7.08	7.52	11.50	19.03	14.60	16.37	100.00
1986	14.03	12.22	9.05	10.41	11.76	14.03	13.57	14.93	100.00
1987	19.14	8.02	5.56	8.02	11.73	16.05	15.43	16.05	100.00
1988	13.43	11.94	8.21	8.21	14.18	17.16	8.21	18.66	100.00
1989	12.90	1.61	12.90	16.13	6.45	19.35	11.29	19.35	100.00
All	14.90	8.92	7.38	8.57	9.91	17.92	14.05	18.34	100.00

	Town A Zone								
Year	S	A	B	C	D	E	F	G	All
1980	32.14%	10.71%	3.57%	10.71%	3.57%	10.71%	14.29%	14.29%	100.00%
1981	33.33	12.82	5.13	0.00	7.69	17.95	7.69	15.38	100.00
1982	41.18	5.88	11.76	5.88	5.88	23.53	5.88	0.00	100.00
1983	26.87	8.96	1.49	7.46	5.97	10.45	25.37	13.43	100.00
1984	19.70	9.09	6.06	1.52	6.06	25.76	16.67	15.15	100.00
1985	18.42	17.11	3.95	6.58	11.84	15.79	15.79	10.53	100.00
1986	25.35	14.08	4.23	9.86	5.63	12.68	14.08	14.08	100.00
1987	32.76	8.62	1.72	6.90	10.34	13.79	13.79	12.07	100.00
1988	27.78	12.96	7.41	5.56	5.56	14.81	9.26	16.67	100.00
1989	36.36	0.00	9.09	9.09	0.00	27.27	9.09	9.09	100.00
All	26.69	11.50	4.52	6.16	7.19	16.02	14.78	13.14	100.00

	Town B Zone								
Year	S	A	B	C	D	E	F	G	All
1980	3.85%	7.69%	0.00%	11.54%	3.85%	26.92%	15.38%	30.77%	100.00%
1981	11.54	0.00	0.00	3.85	19.23	19.23	23.08	23.08	100.00
1982	5.36	3.57	5.36	10.71	1.79	23.21	23.21	26.79	100.00
1983	8.62	3.45	1.72	8.62	10.34	18.97	12.07	36.21	100.00
1984	5.77	3.85	5.77	1.92	3.85	25.00	21.15	32.69	100.00
1985	6.58	6.58	5.26	6.58	6.58	22.37	19.74	26.32	100.00
1986	5.56	6.94	6.94	11.11	13.89	19.44	19.44	16.67	100.00
1987	10.81	5.41	2.70	5.41	5.41	18.92	29.73	21.62	100.00
1988	4.55	13.64	0.00	0.00	9.09	18.18	22.73	31.82	100.00
1989	0.00	0.00	4.17	8.33	8.33	20.83	20.83	37.50	100.00
All	6.46	5.12	4.01	7.35	8.02	21.38	20.27	27.39	100.00

	Town C Zone								
Year	S	A	B	C	D	E	F	G	All
1980	11.54%	7.69%	23.08%	11.54%	19.23%	3.85%	15.38%	7.69%	100.00%
1981	5.13	2.56	17.95	15.38	5.13	30.77	7.69	15.38	100.00
1982	18.75	9.38	0.00	12.50	15.63	15.63	12.50	15.63	100.00
1983	15.79	5.26	26.32	21.05	10.53	10.53	5.26	5.26	100.00
1984	10.45	11.94	8.96	7.46	7.46	19.40	7.46	26.87	100.00
1985	12.16	10.81	12.16	9.46	16.22	18.92	8.11	12.16	100.00
1986	11.54	15.38	15.38	10.26	15.38	10.26	7.69	14.10	100.00
1987	11.94	8.96	10.45	10.45	16.42	16.42	8.96	16.42	100.00
1988	3.45	10.34	12.07	13.79	24.14	18.97	1.72	15.52	100.00
1989	14.81	3.70	22.22	25.93	7.41	14.81	3.70	7.41	100.00
All	10.88	9.86	13.35	12.11	14.37	16.63	7.60	15.20	100.00

properties in Zone S. The small numbers of sales in individual zones in each town in each year made it both difficult and potentially misleading to draw further general conclusions.

Multiple Regression Analysis
The dependent variable used in all MRA models was inflation-adjusted sales price per square foot of living area (ADJSPSF). Two time variables were employed: DDATE (date of deed: year and month) and BEFAFT, which indicated whether the deed was recorded before January 1, 1984, or after December 31, 1983. If the recording occurred after December 31, 1983, BEFAFT was assigned a value of 1; if the sale occurred prior to January 1, 1984, the value of BEFAFT was 0.

The price influence of all reported distance zone locations was compared with that of Zone G, the most distant zone from each SSA. Therefore, the values or coefficients for each of the reported seven zone variables (S and A through F) represent dollar differences in comparison with the price effects of a Zone G location. A negative coefficient meant that the dollar level of price influence for the zone in question was *lower* than that for Zone G. A positive coefficient meant that it was *higher* than that for Zone G.

Adjusted Sales Price Per Square Foot As The Dependent Variable. MRA was applied separately to the three-town total data set and to the Town A, Town B and Town C data subsets.

The results were impressive statistically. The coefficient of multiple determination (R-squared), which indicated the percent of variance in ADJSPSF explained by the independent variables, was at acceptable to high levels. Moreover, the high F ratios in the models mean that it was almost totally unlikely that the results occurred by chance.

Both DDATE and BEFAFT were highly significant and *positive*, which indicated a continuing (implicitly linear) increase in ADJSPSF over the entire study period. Lot size and square feet of living area were next most significant, followed by number of garage stalls and age at the time of sale.

In Town A, *none* of the zone variables was statistically significant. Moreover, they all were positive. In Town B, on the other hand, *all* zone coefficients were negative. Coefficients for Zones S, B and D were statistically significant. These results indicated a probable negative influence on ADJSPSF associated with Zones S, B and D (and possibly Zone A) locations relative to Zone G.

In Town C, as in Town A, *none* of the zone variables was statistically significant. The Zone S coefficient was negative in both time models, but there was a high probability that this was a chance occurrence.

In summary, there was no evidence of negative price impacts from locations in Zones S, A and B in Town A; there was a small but almost totally insignificant negative impact in Zone S in Town C. In Town B, on the other hand, the negative influences of proximity to the Superfund site (Zones S, A and B as well as D) were both apparent and statistically significant.

Time-Distance Interactions. The MRA models discussed above took into consideration the separate price influences of both time and distance from the pertinent SSA in each town. Other property and transaction characteristics also were included in the analysis with ADJSPSF as the dependent variable.

RECGC made further tests in an attempt to identify and measure the *combined* or *joint* effects of time and distance zone location on ADJSPSF. Special emphasis was placed on "time" after January 1, 1984.

In MRA models, any existing joint or combined effect can be identified and measured through the use of an interactive variable. In this instance, the interactions of the time and location variables were calculated and tested.

(Table 7 shows the interactions of the deed date with each of the distance zone indicators to produce the seven time-distance interactive variables included in the models. Similarly, Table 8 shows the results of using before-after/distance zone interactive variables. Tables 7 and 8 identify the same highly significant variables: DDATE or BEFAFT, SFLIVARE and LOTSIZE. AGE and GARSTALS also are significant.)

All of the distance zone variables were not significant in the three-town total data set. Similarly, all the time-distance interactive variables were not significant except for D/BEFAFT (which was positive). Only the interactive variable for Zone B in Table 7 was negative; all the others in both models were positive. For the three-town total data set, therefore, no post-announcement negative effect of any consequence on ADJSPSF was associated with proximity to the SSAs.

Very similar results were found for Town A. Only the Zone C/DDATE interactive variable in Table 7 was negative. All others, especially for Zones S, A and B, were *positive*. Moreover, only the positive interactive variable for Zone F in Table 7 was statistically significant. None of the BEFAFT interactions was statistically significant.

In Town B, on the other hand, the interactive variables for Zones A and D in Table 7 and for Zones S, A, B and D in Table 8 were all *negative*. All others were positive. None of the interactive variables for Town B was statistically significant, however.

In Town C, only the interactive variables for Zones B and C in Table 7 were negative, but both zones were quite insignificant. *All* interactive variables were positive in Table 8. *No* interactive variable was statistically significant in either Table 7 or 8.

TABLE 7

Comparison of MRA Coefficients and t Values Time-Distance Interactions[1]

Variable	Three-Town Total	Town A	Town B	Town C
SFLIVAREA	−0.01	−0.01	−0.01	−0.03
	(14.67)**	(−6.85)**	(−6.56)**	(−12.49)**
AGE	−0.16	−0.16	−0.25	−0.16
	(−4.47)**	(−2.49)*	(−4.40)**	(−2.56)*
DDATE	8.30	8.14	7.74	7.97
	(15.04)**	(9.21)**	(9.51)**	(7.39)**
LOTSIZE	.0007	.0008	.0007	.0011
	(16.01)**	(4.66)**	(7.68)**	(15.55)**
GARSTALS	6.64	2.60	5.66	9.99
	(5.56)**	(1.37)	(2.74)**	(5.07)**
Zone S	−60.55	−95.68	−113.72	−51.23
	(−0.88)	(−1.06)	(−0.66)	(−0.37)
Zone A	−29.59	−87.86	49.55	−51.03
	(−0.34)	(−0.76)	(0.26)	(−0.34)
Zone B	18.66	−111.46	−160.13	50.16
	(0.22)	(−0.78)	(−0.64)	(0.42)
Zone C	−0.05	15.78	−132.78	32.48
	(−.0007)	(0.12)	(−0.90)	(0.26)
Zone D	−100.61	−215.06	151.70	−163.19
	(−1.27)	(−1.53)	(1.08)	(−1.30)
Zone E	−76.04	−162.86	−111.82	−74.62
	(−1.14)	(−1.57)	(−1.08)	(−0.61)
Zone F	−79.97	−234.42	−36.98	−5.23
	(−1.11)	(−2.11)*	(−0.35)	(−0.04)
S*DDATE	0.71	1.13	1.13	0.58
	(0.88)	(1.07)	(0.55)	(0.36)
A*DDATE	0.35	1.09	−0.60	0.59
	(0.35)	(0.81)	(−0.32)	(0.33)
B*DDATE	−0.23	1.36	1.68	−0.56
	(−0.23)	(0.81)	(0.58)	(−0.39)
C*DDATE	0.03	−0.12	1.54	−0.36
	(0.04)	(−0.08)	(0.88)	(−0.25)
D*DDATE	1.16	2.55	−1.91	1.94
	(1.25)	(1.55)	(−1.16)	(1.33)
E*DDATE	0.90	1.96	1.27	0.84
	(1.15)	(1.61)	(1.04)	(0.59)
F*DDATE	0.95	2.77	0.38	0.09
	(1.12)	(2.13)*	(0.31)	(0.05)
R-Squared	0.62	0.69	0.62	0.71
F Ratio	80.91	35.80	24.25	39.18
Standard Error of Estimate	20.75	17.29	21.14	20.19
Durbin-Watson	1.54	1.79	1.58	1.83
Number of Sales	1,403	485	445	473

1. Time is deed date; ADJSPSF is the dependent variable. 2. Numbers in parentheses are t-values
* = *Significant at the .05 level*
** = *Significant at the .01 level*

These interactive variable findings showed a clear and reasonably consistent pattern. Any negative effects that could be identified and measured in association with proximity to one of the SSAs *after* January 1, 1984, were confined to Town B. Even the negative effects in Town B were not statistically significant, however; they could easily have occurred by chance. In Towns A and C, no measurable or discernible negative effect from proximity to the SSA was indicated, especially after January 1, 1984. Moreover, the interactive model results indicated that the passage of time after the announcement did not

TABLE 8

Comparison of MRA Coefficients and t values Time-Distance Interactions: Before-After January 1, 1984[1]

Variable	Three-Town Total	Town A	Town B	Town C
SFLIVAREA	−0.01	−0.01	−0.01	−0.03
	(13.78)**	(−5.30)**	(−7.01)**	(−11.41)**
AGE	−0.10	−0.10	−0.23	−0.09
	(−2.36)*	(−1.24)	(−3.54)**	(−1.18)
BEFAFT	30.00	30.36	29.94	26.69
	(9.12)**	(5.06)**	(6.79)**	(3.63)**
GARSTALS	5.88	0.94	6.90	8.23
	(4.14)**	(0.38)	(2.93)**	(3.43)**
LOTSIZE	.0008	.0009	.0008	.0011
	(15.19)**	(4.40)**	(7.22)**	(14.58)**
Zone S	−4.94	−7.74	−19.78	−4.30
	(−1.19)	(−1.22)	(−2.51)*	(−0.44)
Zone A	−1.99	−2.94	−11.80	0.30
	(−0.36)	(−0.37)	(−1.13)	(0.03)
Zone B	−7.29	−3.11	−17.58	−4.01
	(−1.34)	(−0.30)	(−1.41)	(−0.45)
Zone C	−2.02	−1.87	−9.63	−0.15
	(−0.42)	(−0.21)	(−1.35)	(−0.02)
Zone D	−8.75	−5.98	−9.84	−5.41
	(−1.76)	(−0.67)	(−1.29)	(−0.57)
Zone E	−1.37	−0.02	−6.00	−7.35
	(−0.34)	(−0.00)	(−1.13)	(−0.81)
Zone F	−3.43	−3.29	−7.87	−6.65
	(−0.85)	(−1.22)	(−1.42)	(−0.68)
S*BEFAFT	7.12	13.58	−1.08	4.59
	(1.47)	(1.89)	(−0.11)	(0.43)
A*BEFAFT	2.25	7.69	−0.39	0.22
	(0.36)	(0.86)	(−0.03)	(0.02)
B*BEFAFT	9.33	8.96	−1.51	12.02
	(1.47)	(0.75)	(−0.11)	(1.21)
C*BEFAFT	10.35	11.21	10.51	8.43
	(1.81)	(1.06)	(1.13)	(0.84)
D*BEFAFT	11.62	8.74	−2.62	16.78
	(2.02)*	(0.84)	(−0.28)	(1.63)
E*BEFAFT	1.32	3.05	0.09	6.04
	(0.28)	(0.37)	(0.01)	(0.62)
F*BEFAFT	5.81	8.38	3.45	10.70
	(1.18)	(1.03)	(0.50)	(0.95)
R-Squared	0.47	0.49	0.51	0.58
F Ratio	43.37	15.34	15.22	21.47
Standard Error of Estimate	24.60	22.18	24.10	24.51
Durbin-Watson	1.70	1.96	1.66	1.95
Number of Sales	1,403	485	445	473

1. ADJSPSF is dependent variable. 2. Numbers in parentheses are t values
** = Significant at the .05 level*
*** = Significant at the .01 level*

enhance or exacerbate any negative effects that a location close to the SSA in Town B already had on ADJSPSF.

Summary

A total data set of 1,423 usable sales of single-family residential properties in three towns in northern New Jersey was studied over the period July 1, 1980, through June 30, 1989. Detailed property and sales transaction information was gathered from public records, published sources and field inspections. The location of each sales property was identified by distance zone from the boundaries of a Superfund site (SSA) in each town. Sales within the SSAs themselves, both before and after January 1, 1984, also were included.

The data sets were subjected to a series of statistical tests to provide a basis for reaching judgments about: (1) whether proximity to a known SSA had a negative effect on residential property values in any of the three towns; (2) how far away from the SSA any negative price effect was felt; and (3) how persistently any such negative effect was felt over time. Three statistical procedures were employed:

- Simple comparisons of averages resulted in graphs depicting the movement of average ADJSPSF in different distance zones.
- Percentage changes were calculated by comparing averages of ADJSPSF before and after January 1, 1984. Trends in sales volume were similarly tested and compared. In addition, changes in the percentage mix of sales by zone for each year within each town were compared.
- Multiple regression analysis received major emphasis. ADJSPSF was the focal dependent variable.

Within MRA, the standard Hedonic Pricing Model was applied using two time measures: (1) deed date, a continuous variable; and (2) before-after January 1, 1984, a binary variable. The coefficients for all reported distance zones represented incremental differences from the price of the most distant zone (G) which served as a control.

Finally, the Hedonic Pricing Model was modified to incorporate time-distance interactions of both deed date and before-after time in combination with distance zone.

Conclusions

The results of the statistical tests and their findings led to the following conclusions.

Only in Town B was there any systematic, significant negative effect on ADJSPSF *and* on sales volume for properties close to the SSA. In Towns A and C, where remediation and cleanup were completed promptly, no systematic or significant negative effect was evident except in sales volume in 1989. The period of this decline in sales was too brief to provide a basis for generalization.

After January 1, 1984, patterns of negative effects on ADJSPSF were spotty, un-systematic and generally insignificant. The only consistent negative impacts appeared in Town B, in Zones S, A, B and D. Even there, negative interactive time-distance variables were not significant. Most consistent was a lower rate of increase in average ADJSPSF in Zone S generally and in Zones A and B in Town B.

Sales volumes in the distance zones closest to the SSAs did not decline perceptibly in the years immediately following the December, 1983, announcement. Any decreases that did occur were quite temporary. In 1988 and 1989, however, when the general level of residential sales volume decreased throughout the market area, the declines were much sharper in Zones S, A and B. No direct association with proximity to the SSAs was demonstrated, however.

No measurable negative impact beyond the SSA was evident in Towns A and B. Even there, the post-announcement effects were not significant. In Town B, on the other hand, negative price (and sales volume) effects were found with properties located at least 500 feet from the outer boundary of the SSA through Zone B. It is arguable that the negative impact extended through Zone D (1,500 feet away from the SSA) in Town B, even though the measurable effects in intervening Zone C was *positive*.

Standard MRA using the Hedonic Pricing Model supported and clarified these conclusions based on comparisons of averages and comparisons of trends. Negative statistically significant coefficients associated with location were found in Town B only. There the coefficients for Zones S, A and B were both negative and statistically significant. There was no such impact in Town A or Town C.

The foregoing conclusions also were reinforced when interactive time-distance variables were incorporated into the Hedonic Pricing Model. The negative impacts noted in Zones S, A and B in Town B were generally not significant; nevertheless, there was a continuing negative impact associated with property locations in Zones S, A and B after January 1, 1984, in Town B only, through at least June, 1989.

Any continuing, significant negative price impacts associated with proximity to an SSA were limited to Town B. The SSA within Town B was the site within which barrels of radioactive soil were prominently stored in the open for more than two years with attendant continuing publicity. Several contaminated properties in this town were fenced off, and danger signs warning of radiation hazards were prominently displayed.

The Superfund sites in Towns A and C, on the other hand, were cleaned up expeditiously, and they had none of the adverse publicity that persisted in Town B. As a result, their potential negative impacts were effectively eliminated. Accordingly, no significant negative effects on ADJSPSF or sales volume emerged. Indeed, with the exception of properties within the Superfund site itself in 1988 and 1989, no negative price effect was identified in Towns A and C.

Therefore, the market response to proximity to a known SSA was a direct function of the speed and apparent effectiveness of any remediation or cleanup effort. These results were generally consistent with findings from other, similarly designed and executed statistical studies in other states.

CURRENT LEGAL ISSUES RAISED BY ENVIRONMENTAL HAZARDS AFFECTING REAL ESTATE

Real estate investors and practitioners need to comply with regulations and laws governing the sale and maintenance of environmentally contaminated or protected properties.

by Ralph W. Holmen

Following two centuries of industrial, commercial, residential and even recreational misuse of America's natural environment and resources, the last several decades have seen significant public concern for protecting the environment from continuing degradation. Federal, state and even local governments have recognized and responded to this concern with a variety of legislative and regulatory programs intended to preserve environmental quality. While much of this effort seeks to ensure clean air and water, a significant amount of environmental regulation seeks to clean up or prevent further contamination of land. Owners, lessors, lessees, buyers, sellers, lenders and brokers of real estate as well as others involved in real estate transactions must cope not only with the health risks and hazards of environmentally affected real estate, but also with the laws that govern environmentally contaminated and protected property.

A variety of environmental hazards may affect real estate. Commercial and industrial facilities most often are environmentally contaminated by substances that have been inadvertently or carelessly discharged onto property. These facilities, for example, may contain asbestos in the form of insulation or fireproofing materials, or they may overlie abandoned or operational underground storage tanks that are sources of soil or groundwater contamination. Residential properties may be environmentally contaminated by insulation, carpeting or building materials that emit radon, lead, asbestos particles or formaldehyde gas or by materials employed by a previous commercial user. Residential properties also may be environmentally threatened by underground storage tanks and by electromagnetic fields emanating from electric transmission and distribution lines and other power sources. Residential or commercial/industrial properties may be limited in their development by environmental interests in preserving coastal areas, endangered species' habitats or wetlands.

As one might expect, legislative measures adopted to address environmental problems, and the ways in which these laws may affect real estate, are numerous and complex. The purpose of this article therefore is to identify the most prominent environmental problems addressed by legislative and/or regulatory schemes.

Superfund

Perhaps the most infamous environmental issue affecting real estate originated with the Comprehensive Environmental Response, Compensation and

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Liability Act of 1980[1] (also known as Superfund or CERCLA) which imposes liability for the costs of cleaning up seriously contaminated property on persons who are or have been involved with the property (often referred to as *potentially responsible parties* or PRPs). PRPs include owners who had no involvement in, control over or even knowledge of the release of environmental contaminants or individuals who acquired the property after it became contaminated but had no knowledge of the contamination at the time of purchase.

The Superfund law is administered and enforced by the U.S. Environmental Protection Agency (USEPA); it empowers USEPA to order the owner of property that has been severely contaminated by hazardous wastes to clean up the site or to conduct the cleanup and secure reimbursement of the cost of doing so from the PRPs. They may be held strictly liable for such costs, which often are of a staggering magnitude measured in millions or tens of millions of dollars.

There are, however, two important exemptions to Superfund liability, both of which are the subject of considerable debate and activity. Superfund exempts from liability persons who, without participating in the management of a facility, hold indicia of ownership primarily to protect a security interest. Although this provision was intended to benefit real estate mortgage lenders, its scope has been narrowed dramatically by judicial interpretation of its language. Court decisions have held a lender to be liable for Superfund cleanup expenses if the lender temporarily becomes the owner of a contaminated property through foreclosure. In addition, in U.S. v. Fleet Factors Corp.[2] the court held that a lender could be liable if it had the *capacity* to influence the property owner's treatment of wastes or contaminants on the property whether or not it exercised that power. Although at least one subsequent court decision reached a contradictory conclusion, lenders understandably have become cautious about making loans secured by real estate unless the environmental condition of the property has been determined. Lenders also have become unwilling or reluctant to foreclose on property which is or may be contaminated. They also hesitate to manage the affairs of a delinquent borrower whose loan is secured by contaminated real estate, for fear of negating the secured lender exemption to Superfund liability.

Several attempts to correct this problem are underway. U.S. Rep. LaFalce (D-NY), Owens (D-Utah) and Weldon (R-PA) and Sen. Garn (R-Utah) have introduced legislative proposals that would (1) expressly prescribe the actions lenders may undertake to protect their collateral without voiding Superfund's secured lender exemption and (2) establish limits on lenders' liability for cleanup costs. In addition, USEPA has released for public comment a rule that describes specifically the extent to which a secured lender may participate in the affairs of a borrower whose loan is secured by contaminated real estate. This proposed rule also itemizes the circumstances under which a lender may foreclose on and liquidate its interest in a contaminated property without incurring liability for Superfund cleanup expenses. The rule further exempts from liability government entities that involuntarily succeed to ownership or control of contaminated property. This provision is particularly important to the Resolution Trust Corporation (RTC), Federal Deposit Insurance Corporation (FDIC) and other government agencies that are or may become owners of a large inventory of properties previously secured by loans made by failed financial institutions.

Superfund also exempts from liability innocent purchasers, that is, individuals who acquired property without knowing or having any reason to know that the property was contaminated. To establish that one did not have reason to know of the contamination and thus qualify for this exemption, Superfund requires a purchaser to demonstrate that he had undertaken at the time of acquisition, all appropriate inquiry into the previous ownership and uses of the property consistent with good commercial or customary practice. Thus, one must conduct an adequate inspection or examination of the property—often referred to as due diligence—to be entitled to this exemption from liability. Unfortunately, neither the Superfund statute nor its regulations prescribe the nature or extent of the due diligence investigation that would be required. Potential purchasers consequently are uncertain of the degree of inspection that will allow them to claim this exemption for a property that subsequently is discovered to be contaminated.

To fill this void, the American Society for Testing and Materials (ASTM), a private standard-setting organization, has initiated an effort to establish an appropriate standard of investigation that will allow property purchasers to qualify for the exemption. A variety of private and public sector concerns are involved in this effort, including representatives from lending institutions, real estate organizations, corporate property owners, and government and environmental consultants. Although the standard ASTM intends to adopt through this process will be voluntary and therefore not bind courts or administrative agencies such as USEPA, compliance with the standard nevertheless may be viewed as persuasive evidence that the statutory "all appropriate inquiry" requirement has been satisfied. It is anticipated that this standard will be finalized and adopted in 1992. In addition, the legislation introduced by Reps. Owens and Weldon also includes provisions designed to define statutorily the investigation that is necessary to qualify for the innocent landowner exemption to Superfund liability.

Although of great concern to real estate owners, buyers, sellers or lenders, Superfund has virtually no direct application to real estate brokers, agents or other real estate professionals because their activities do not bring them within Superfund's definition of PRPs. Superfund liability applies only to a

real estate professional who qualifies as a PRP because he is an owner or operator of a contaminated site, has caused or permitted contaminants to be released on the site or has transported or arranged for the transport of the contaminants to the site. None of these activities, of course, is typical conduct of most real estate professionals.

One reported court case has addressed the potential liability of a real estate broker under Superfund. In Tanglewood East Homeowners v. Charles-Thomas, Inc.,[3] the plaintiffs sued a number of parties involved in the development of a housing subdivision, including the real estate brokerage firm that handled the sale of the homes, to recover costs incurred in cleaning up toxic wastes found on the property. The court held that the defendants, including the brokers, could be liable under Superfund as transporters of the contaminating waste because of grading and other related development work. However, this case *does not* provide a basis for imposing Superfund liability on real estate brokers that act solely as brokers and merely market a property. According to this case, only if brokers are involved in property development can they be held liable under Superfund.

State Superfund Laws

Numerous state legislatures have adopted Superfund-like statutes that give states the authority to clean up contaminated sites and claim reimbursement from certain parties for the cleanup costs incurred. Although a variety of permutations and peculiarities exist among the various statutes, most are modeled after Superfund. Like the federal statute, "little Superfund" statutes do not extend liability to real estate professionals who act only in their brokerage capacity.

A number of states have added a twist to their Superfund-like statutory schemes, however. Federal Superfund and similar statutes in at least 21 states allow a lien to be imposed against property for the costs of environmental cleanup. Some statutes extend this lien to other property within the state that is owned by the same party. In 16 states, this lien is an ordinary one, subject to prior liens; however, in five states (Connecticut, Maine, Massachusetts, New Hampshire and New Jersey), the lien is a so-called Superlien, which takes precedence over all other prior liens. In three of these states (Connecticut, Massachusetts and New Jersey), the Superlien acts as a regular priority lien in the case of residential property; nevertheless, in all five states, the lien has first priority over any other security interests in the property that is subject to cleanup.

Underground Storage Tanks

USEPA estimates that there are several million underground storage tanks containing petroleum or hazardous chemicals in the United States. The majority of these tanks and their piping are constructed of unprotected steel; therefore, they are subject to leakage resulting from corrosive decay. Leakage from underground storage tanks can cause fires or explosions, and it can contaminate underground water systems. As a result of concern about the dangers and environmental damage produced by this leakage, Congress in 1984 and again in 1986 acted to regulate underground storage tanks; many states and even some local jurisdictions also have adopted legislation governing these potential environmental hazards.

The objective of federal legislation covering underground storage tanks[4] is to prevent, detect and correct leaks and spills and the corresponding environmental damage they create and to require owners and operators of underground storage tanks to meet certain standards of financial responsibility. Tanks installed after December 1988 must meet standards of construction designed to prevent or resist decay from corrosion and to prevent spills and overflows. Because much tank leakage arises not in the tank itself but in the associated piping, the piping also must meet such standards. In addition, new tanks and piping must be equipped with a leak detection system, and they must be monitored for leaks at least monthly.

Existing tanks must be improved by adding corrosion protection and leak detection features that satisfy the requirements for new tanks. The deadline for making these improvements depends on the tank's age; tanks installed before 1965 must meet these requirements sooner than tanks that were installed later. By December 1993, all tanks must be equipped with leak detection systems, and by 1998, all tanks must have corrosion, spill and overflow protection.

In addition to these requirements regarding the quality of tanks and their leakage monitoring systems, USEPA regulations require any suspected or confirmed leak or release and the action taken to correct any damage to be reported to federal or appropriate state authorities.

Closure, or cessation of the use of underground storage tanks, on a temporary or permanent basis, also is regulated by federal law. If use of a tank is to be terminated permanently, the owner of the tank must inspect for and clean up any damage caused by leakage; empty and clean the tank of all remaining liquid, vapors or sludge, and remove the tank or fill it with a stable inactive substance such as sand. If a tank is to be closed temporarily, the leak detection system must be in operation as long as the tank contains materials.

Some underground storage tanks are exempt from these requirements. The most significant exemptions are for farm or residential tanks that hold fewer than 1,100 gallons of motor fuel for noncommercial purposes and tanks that store heating oil for use on the premises. However, even tanks that are exempt from federal regulation may be subject to rigorous state or local regulation.

Property containing underground storage tanks subjects the owner to a plethora of maintenance requirements as well as liability for the environmental damage that leakage from a tank may cause. Owners or potential purchasers of such property therefore must be careful to consider, understand and comply with these requirements.

Lead

Another potentially harmful substance to which many Americans may be exposed in the environment is lead. It enters the human body by inhalation or ingestion and accumulates in the blood, bones and soft tissues. Excessive concentrations of lead in the body can seriously damage the central nervous system, brain, kidneys, red blood cells and in some cases cause death. Children, pregnant women and their fetuses are particularly susceptible to the damaging effects of lead, suffering adverse effects from low concentrations of lead in the body.

Two common sources of lead exposure are residential drinking water and house paint. Lead gets into residential drinking water by leaching from lead-containing pipes or other plumbing materials, including the solder used to join pipes. Although the use of lead and lead-based plumbing materials is now prohibited, many residences contain lead pipes or solder that were installed prior to 1986 when that prohibition was adopted.

Although use of lead-based paint was banned in 1978, a recent government survey shows that it is still contained in many homes built before 1980. It is believed to be a hazard primarily to children who ingest chips of flaking paint. However, the U.S. Department of Health and Human Services and USEPA recently identified house dust tainted with lead paint particles as a major source of lead exposure. Lead-based paint chalks over time and may be released into the air from painted surfaces subject to frequent contact, such as window frames and wells. Scraping or sanding paint during remodeling projects also generates lead-paint dust.

The U.S. Department of Housing and Urban Development has established a program for reducing or eliminating lead-based paint in public housing, and USEPA has undertaken efforts to reduce exposure to lead. Among the pieces of legislation introduced in Congress to reduce exposure to lead is a comprehensive bill that will require sellers, lessors and/or real estate brokers to test for and disclose the presence of lead-based paint in residential properties prior to sale.

This recent legislative and regulatory emphasis on the dangers of lead poisoning make it clear that concern about this problem is likely to increase, and owners, lessors, investors and real estate professionals involved with properties that may be the source of lead exposure will be subject to increased regulation.

Disclosure Statutes

Several states have adopted legislation that applies specifically to the environmental condition of property involved in a real estate transaction. The states of California, Connecticut, Illinois, Indiana and Oregon impose disclosure obligations in connection with transactions of certain types of commercial or industrial properties that may be environmentally contaminated. New Jersey has enacted a significantly more rigorous statute, requiring that property containing "industrial establishments" be certified as clean or that any environmental contamination be eradicated, before sale of the property may be completed.

Several states, including Florida, Massachusetts, Montana and New Hampshire, have codified in law the obligation to disclose the presence of or general information about various environmental hazards common to residential properties, such as radon, urea formaldehyde foam insulation, lead paint or underground storage tanks. Two states, Maine and California, have focused specifically on the broker's role in the sale of residential property that potentially may be affected by environmental problems. These states expressly require real estate agents to disclose to buyers of residential properties specific types of information provided by the seller, including known environmental characteristics or problems. In California, a statutorily prescribed form, which includes certain items relating to environmental matters, must be completed by the seller and delivered to the buyer. Maine does not mandate the use of a particular disclosure form but does set forth by regulation those aspects of the property, including specified environmental matters, that must be addressed by such disclosure.

Real estate transaction-invoked environmental disclosure statutes are becoming more widespread, and they are being considered in numerous jurisdictions which have not yet adopted them. Whether such a statute has been enacted and, if so, its specific requirements should be reviewed by those engaging in real estate transactions.

Common Law Disclosure Responsibility Of Real Estate Professionals

In virtually every state, caveat emptor has been discarded even in real estate transactions. As a result, real estate brokers and agents have a statutory, regulatory or common law obligation to disclose any property defects of which they are aware. Such defects may include environmental problems with the property. Because real estate agents ordinarily lack expertise in technical environmental matters, they often are not aware of the presence of such problems unless they are advised by the seller. Whether an agent has an affirmative obligation to identify actual or suspected environmental problems with the property, in spite of the lack of expertise in technical environmental matters, is not clear. Somewhat surprisingly, few court cases have addressed the broker's duty to discover or disclose environmental problems which may be present on the property.[5-7]

In Roberts v. Estate of Barbagello, the court held a real estate firm and its agent liable *not* for failing to disclose the known or suspected presence of an environmental hazard (in this case, urea-formaldehyde foam insulation) but for failing to advise the buyer about the possible effects of the insulation. The court reasoned that this duty was necessary because the broker's failure to disclose the effects of the insulation would "prevent (the buyer) from investigating the insulation in the house prior to signing the agreement of sale or the closing" and that the buyer would investigate if she was advised. The court did not limit this duty to circumstances in which the real estate agent knew or even "should have known" that urea formaldehyde foam insulation was present.

The facts of the Roberts case narrow the apparently wide scope of the court's ruling. The agent had asked the seller about the insulation and had been told that the type of insulation was not known but that it had been blown in. The agent's real estate firm was aware of the following: the Consumer Product Safety Commission's ban against installation of urea formaldehyde foam insulation (which was later invalidated by a federal court); the recommendation of the National Association of Realtors and the local board of Realtors that information about this type of insulation should be provided to buyers; and an advisory of the county health department that specified levels of formaldehyde gas could cause eye, nose and throat irritation. Despite this knowledge, the firm had adopted a policy of *not* providing buyers with information about urea formaldehyde foam insulation. Thus, although the court's decision appears to impose a rather heavy burden on real estate agents to disclose information about hypothetical environmental concerns, the facts of the case suggest that the firm or agent was aware of information that constituted a "red flag" for the presence and the perceived dangers of urea formaldehyde foam insulation.

Brock v. Tarrant also involves an agent's alleged failure to disclose the presence of urea formaldehyde foam insulation in the home. In this case, the *sellers* were aware of the elevated levels of formaldehyde gas in the home and had instituted litigation against those who had sold and installed the insulation. The sellers nevertheless represented to the agent that the property did not require repairs, that it had no structural defects and that the lawsuit (the nature of which was not revealed to the agent) would "definitely not affect" a purchaser's interests. The court in this case held that the agent was not liable because he had no reason to suspect that the sellers' statements were false, and therefore he did not breach the standard of care "to take reasonable steps to avoid disseminating to the buyer false information. (and to) employ a reasonable degree of effort and professional expertise to confirm or refute information from the seller which he knows, or should know is pivotal to the transaction from the buyers perspective."[8]

Finally, Smith v. Renaut also held that when a real estate agent has no knowledge of the presence of an environmental hazard nor any basis to suspect its presence, he is not liable for failing to disclose information about the hazard. Smith involved both termite damage to the property as well as the presence of chlordane, a toxic insecticide that is no longer in use, in the property's well water. The agent was found liable for advising the buyer not to worry about the minor termite damage on the property because there was, in fact, significant termite damage. The court found that the agent was not liable, however, for failing to disclose the presence of chlordane in the well water, because neither the agent nor the seller was aware of the problem, and because the agent made no statement about the condition of the well.

The latter two cases apply essentially the same standard of liability as that employed in cases involving more familiar, non-environmental property defects. That standard requires disclosure of defects such as environmental hazards of which the broker has actual knowledge or a reasonable basis for suspicion. These cases also suggest that a broker may rely on information provided by the seller unless he has a reason to believe that information may be incorrect. Even the Roberts case, when construed narrowly in light of its facts, is consistent with this analysis if one makes the quite reasonable assumption that the owner's statement about the insulation being "blown in" may be considered a "red flag" for the presence of urea formaldehyde foam insulation.

Several commentators have suggested that the proper standard of care concerning environmental matters might be one based on Easton v. Strassburger[9] and would require the broker to perform a reasonable investigation for signs of environmental hazards and disclose the results to the buyer.[10] It also has been suggested by some commentators that a form of the due diligence investigation obligation established by the innocent purchaser exception to Superfund liability ultimately may be applied to brokers and agents in determining their duty to inspect property for environmental flaws. Fairness and reason require that, whatever standard by which brokers and agents are to be judged, they should be expected to identify only those signs of environmental hazards which their training as real estate professionals makes them qualified to recognize.

Whether the broker's duty to inspect for and disclose information about environmental hazards in a particular jurisdiction does, in fact, require the inspection suggested by Easton or is the somewhat more limited duty indicated by Tarrant and Smith, prudent real estate agents are well advised to be prepared to recognize the red flags of common environmental hazards and point them out to clients and customers. As suggested above, such concerns may include radon, urea formaldehyde foam insulation, asbestos, pesticide use, underground storage tanks and lead paint. They also could be extended to other, still-to-be identified sources of environmental

hazards such as electromagnetic fields emitted by nearby power lines. Brokers and their agents can limit their exposure by adopting regular practices designed to reveal and disclose to buyers any environmental hazards that may be present.

Land Use Restrictions Imposed For Environmental Purposes

Real estate and real estate transactions may be affected by legislation that prevents or limits the use of property, or certain kinds of properties, in order to prevent environmental injury or serve other environmental objectives. Examples of such laws are coastal or beachfront management restrictions that forbid development within a certain proximity to bodies of water, that impose restrictions or procedures on siting waste (hazardous or non-hazardous) disposal or repository facilities or that limit the extent or nature of development and use of areas designated as habitats for endangered species. Perhaps the most pervasive and controversial legislative scheme of this type restricts the use of wetlands.

Wetlands Protection

Federal protection of wetlands arises primarily from Section 404 of the Federal Water Pollution Control Act (also known as the Clean Water Act),[11] which authorizes the U.S. Army Corps of Engineers to issue permits for the discharge of dredged or fill materials into the waters of the United States, including wetlands. Permits issued by the Army Corps of Engineers are subject to the approval of the USEPA. From this authority to issue permits for the development or use of wetlands has emerged an extensive regulatory program.

Wetlands are the familiar areas adjacent to oceans, lakes, rivers and streams, but they also may include areas subject to periodic but not continual inundation. Wetlands serve a number of important and useful ecological functions, including water purification, groundwater supply recharge, flood control and wildlife refuge. Increasing concern about the continued destruction or alteration of wetlands has collided squarely with increasing pressures for development of residential, commercial and industrial areas, roads and other public and private facilities needed to support an expanding American society. President George Bush announced in 1988 a "no net loss" policy applicable to wetlands. This policy encouraged preservation of wetlands or the establishment of new wetlands areas to replace those that were altered or destroyed.

Real estate interests quite obviously are affected by restrictions imposed on development so wetlands areas can be preserved. Questions about the need and appropriateness of such limitations have generated response in several areas:

- In 1989 the Corps of Engineers, USEPA, Soil Conservation Service and the Fish and Wildlife Service jointly adopted the *Federal Manual for Identifying and Delineating Wetlands*. As the title implies, this manual is used to determine the boundaries of wetlands for regulatory purposes. The manual provides for each regulatory agency a uniform means of identifying the presence of wetlands.

  Many property owners and others subject to wetlands regulation have asserted that the 1989 manual inappropriately expands the definition of wetlands, resulting in an expansion of the types of properties that are subject to wetlands limitations and regulation. Hearings were held in 1990 to air concerns about the expansion of wetlands jurisdiction, and at least one lawsuit is challenging the validity of the manual. Revisions have been developed for the manual and are expected to be published for public comment soon. Although these revisions are not yet final, observers believe that they will reduce the scope of the definition of wetlands and the number of property owners subject to the wetlands regulation by the Army Corps of Engineers and USEPA.
- Several court cases have raised the issue of whether denial of a wetlands development permit by the Corps of Engineers or USEPA constitutes a "taking" of property which, under the Fifth Amendment, is unconstitutional unless the property owner is compensated. One case, Loveladies Harbor v. United States,[12] held that denial of a permit constitutes a taking of property which requires compensation. That case is on appeal in the Court of Appeals for the Federal Circuit, and an appeal to the U.S. Supreme Court may follow.
- At least two pieces of legislation have been introduced in Congress that seek to eliminate or modify the Section 404 wetlands regulatory program and improve wetlands regulation. Rep. Hayes (D-IL) has proposed a bill that would replace the current regulatory program with a scheme requiring wetlands to be classified according to their value and ecological importance. This bill would permit expedient development of wetlands that provide little or no ecological benefits, and it would require compensation to be paid to owners of wetlands that were too valuable to be altered or destroyed. Rep. Hayes has secured a large number of cosigners for this legislation, and a similar bill may soon be proposed in the Senate.

  Rep. Thomas (D-GA) has proposed a less radical reform plan which would revise existing wetlands regulation by statutorily embracing the "no net loss" policy, providing for wetlands delineation by a rulemaking process, allowing for wetlands mitigation banking in connection with permit applications, requiring mapping of wetlands and methods for assessing their functions and values.

Conclusion

Real estate practitioners, owners, lenders and users can no longer fail to be cognizant of and responsive

to legal issues associated with environmental contamination and protection. Today some measure of environmental review or assessment is part of almost every real estate transaction of significant size. The legal concerns discussed in this paper are among the most significant, although undoubtedly other problems and issues will emerge in years to come. Anyone with an interest or involvement in real estate matters will benefit by becoming familiar with the legal aspects of current and yet-to-be identified environmental matters.

NOTES

1. 42 U.S.C. §§9601-9675 (1980).
2. 901 F.2d 1550 (11th Cir. 1990).
3. 849 F.2d 1568 (5th Cir. 1988).
4. 42 U.S.C. §§6991-6991h and USEPA regulations at 40 C.F.R. Part 280 Subparts A-G (1990).
5. *Roberts v. Estate of Barbagello*, 531 A.2d 1125 (Pa Super. 1987).
6. *Brock v. Tarrant*, 57 Wash. App. 562, 789 P.2d 112 (1990).
7. *Smith v. Renaut*, 564 A.2d 188 (Pa Super. 1989).
8. *Hoffman v. Connall*, 108 Wa. 2d 69, 736 P.2d 242 (1987).
9. 152 Cal. App. 3d 90, 199 Cal. Rptr. 383 (1984).
10. See, Toxic Nightmare on Elm St. Negligence and the Real Estate Broker's Duty in Selling Previously Contaminated Residential Property, 15 B.C. Env. L. Rev. 547 (1988); Environmental Liability of Brokers and Other Parties, 19 Real Est. L.J. 218, 277 (1991); Environmental Problems and Brokers Liability, 3 Nat. Res. and Env. 17 (1988). But to the contrary, see, Home Not-So-Sweet Home: Real Estate Broker Liability in the Sale of Previously Contaminated Property: Has Broker Liability Gone Too Far? 21 Rutgers L.J. 111 (1989).
11. 33 U.S.C. § 1344.
12. 21 Cl.Ct. 153 (D.C.Cir. 1990).

A CASE FOR AN ENVIRONMENTAL REAL ESTATE MARKET

If environmental real estate is a contemporary market, real estate counselors need to recognize that supply and demand factors influence its value.

by Donald C. Wilson

As more and more lands with environmentally significant attributes (e.g., wetlands, shorelines, endangered species' habitats, etc.) transact for the purpose of conservation, a valuation question arises for real estate counselors: do these lands, related transactions and transactors constitute a market?

The Significance Of Asserting A Market

If conservation lands, related transactions and transactors do constitute a market, then counselors should be able to use comparable sales properly drawn from the market as valid indications of market value. If they do not constitute a market, counselors probably will continue to be asked by public agencies to appraise these rarely condemned lands by using condemnation valuation methodology, to ignore highly comparable sales involving public agencies and rely on sales of dissimilar properties bought for alternative uses in more traditional markets. In short, counselors will continue to be asked to ignore in their valuation of conservation lands the most probable use of many properties—conservation—and the most similar comparable sales—properties purchased for conservation.

Valuation of protected wetlands is an example. A counselor may be asked to rely on sales of lands with alternative uses involving private parties, rather than rely on relatively similar sales of wetlands involving public agencies. The potential for estimation error, because of reliance on dissimilar comparable sales, and ensuing transactor conflict is significant.

Public agencies encourage counselors to apply condemnation valuation methodology often because of policy. This policy has four apparent roots:

1. Public agencies have condemnation power; so even if they are not planning to use it, they apparently think they must follow condemnation valuation methods in case they change their minds and decide to condemn these properties.

2. The historic tendency of public agencies to use condemnation power to acquire other types of lands, particularly for transportation and utility right-of-ways, has created a habit of valuing other lands in this way.

3. Public agencies find standardization of appraisal approaches cheaper and easier to deal with; so they impose condemnation valuation across the board regardless of its appropriateness.

4. Bureacratic inertia.

None of these is a particularly persuasive reason for continuing the policy, and all fly in the face of

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the fact that public agencies rarely condemn conservation lands. Experience suggests that most acquisitions of land for conservation purposes are made by negotiated purchase, with negotiations open to competition from other public agencies, land trusts, wildlife organizations and for-profit entities.[1] Further, many public agencies openly advocate negotiated purchases and frequently will delay a transaction indefinitely rather than incur the political and financial costs of condemnation. Finally, land owners frequently negotiate as if condemnation were an unlikely possibility.

Given these factors, public agencies' reliance on condemnation valuation methodology and their disregard for the use of significant, comparable sales involving public agencies is inconsistent with reality (public agencies tend to negotiate purchase rather than condemn), frequently unnecessary (it is based on policy not law) and likely prone to estimation error and transactor conflict (several buyers and sellers had litigated for decades over disagreements concerning the value of conservation properties).

Hence, the only valid reason for many public agencies to continue their policy is if the lands, transactions and transactors involved simply did not constitute a market. This article asserts the contrary: i.e., that these lands, transactions and transactors do constitute a market, that the basic condition for estimating market value—the existence of a market—is met and that comparable sales properly drawn from this market constitute valid indications of market value.

Environmentally Significant Land Defined

Environmentally significant land or conservation land are accurate terminologies for land that has environmentally significant attributes. The former term is advocated here, since conservation land (i.e., land protected as it is) is only one type of environmentally significant land. Other environmentally significant lands include those protected for rehabilitation purposes (e.g., a degraded wetland) or those protected for the introduction of significant environmental attributes (e.g., an upland graded and flooded to mitigate destruction of wetlands elsewhere).

Environmental Real Estate vs. Environmentally Significant Land

Environmentally significant land is a resource; real estate with environmentally significant attributes is space that has been delineated by man, relative to a fixed geography, to contain an activity for a period of time.[2] The activity may include conservation, rehabilitation or introduction of environmentally significant attributes. The period of time may be perpetuity or a designated number of years.

The distinction between land and real estate is significant because transactors do not value and transact for environmentally significant land; they value and transact for ownership interests in real estate encompassing environmentally significant attributes. These may be land, flyways over the land, antiquities buried in the land, events that once happened on the land, etc. Interests may be full or partial. Environmental real estate therefore is selected as a suitable term for property rights to environmentally significant land.

Environmental Real Estate Defined

Environmental real estate is a space-time delineation (e.g., park days, wetland acres in perpetuity, etc.) relative to a fixed geography that has been delineated by humans to conserve, rehabilitate or introduce attributes of geographical, biological, ecological, archaeological or historical significance. It is a subset of real estate—not exclusive of it.

Further, environmental real estate is a spatial infrastructure much as transportation, sewers and utilities. Environmental real estate not only serves a basic function (providing the consuming public with the environment it is willing and able to pay for); it also shapes where and how society lives. As society once controlled and channeled development with transportation and utility infrastructure, it now may use environmental real estate.

The Case For An Environmental Real Estate Market

For environmental real estate, related transactions and transactors to constitute a contemporary real estate market, one would expect to find consistency with a basic definition of a market, distinguishable characteristics of supply and demand, market facilitation of pricing and supply and significant governmental regulation and subsidy.

Consistency With A Basic Definition Of A Market

"A market," Martin L. Bell says, "is composed of people, people with money, people with money wanting goods and services; and the basic opportunity in marketing is to provide these people with want-satisfying goods and services."[3] People, it may be added, may act individually or through organizations to satisfy their wants.

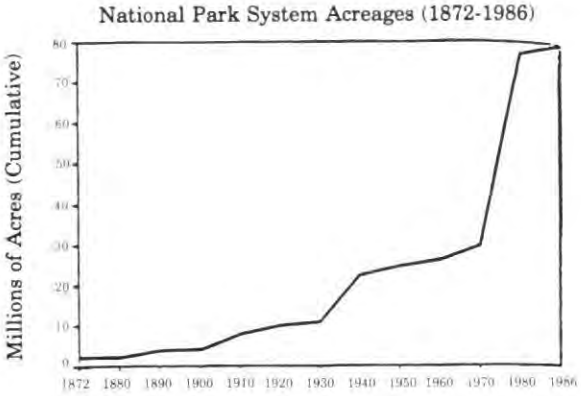
Looking at environmental real estate transactions in the United States through the lens of this very basic definition, yields a readily recognizable market. The market is citizens (people) with money acquiring the environmental real estate they want through public agencies (tax monies), private not-for-profit corporations (contributions and surpluses from operations) or directly (typically with user fees, occasionally with fee simple acquisition) in the space-time unit they want (e.g., a park day, an acre in perpetuity, etc.). Many segmentations of sub-markets also are possible.[4]

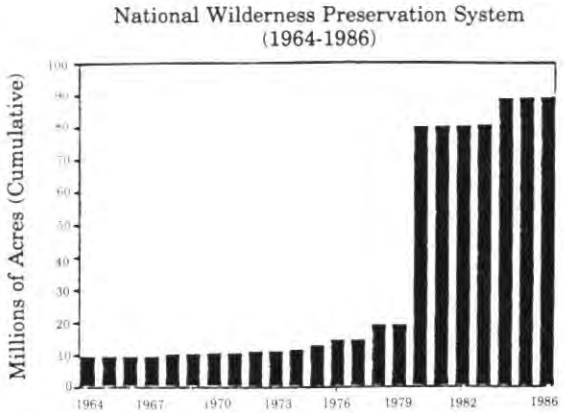
Distinguishable Characteristics Of Supply

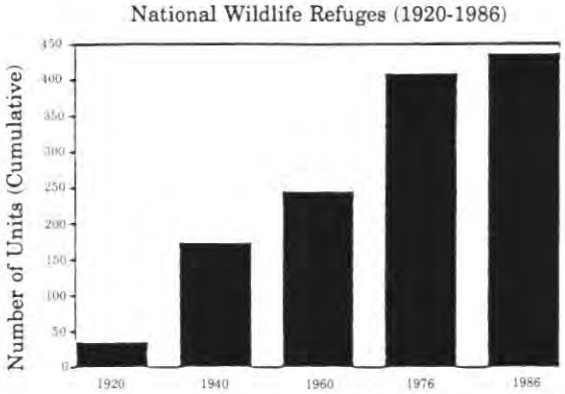
Supply in a regulatory context may be designated (expressly protected by statute or policy) or undesignated (not expressly protected, but likely to be if traditional development were proposed). Properties outside of these classifications may be actually or potentially significant, but they may not be put to such use; therefore, they may be distinguished as tertiary.

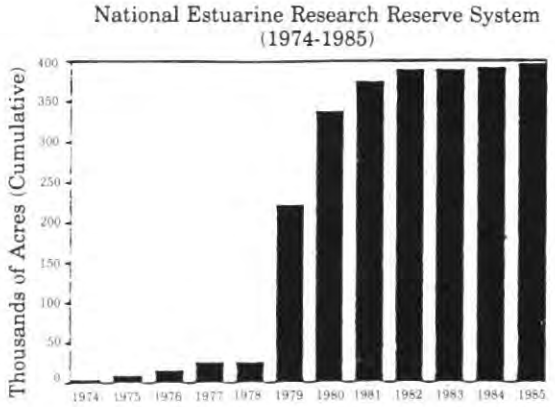
Exhibit I

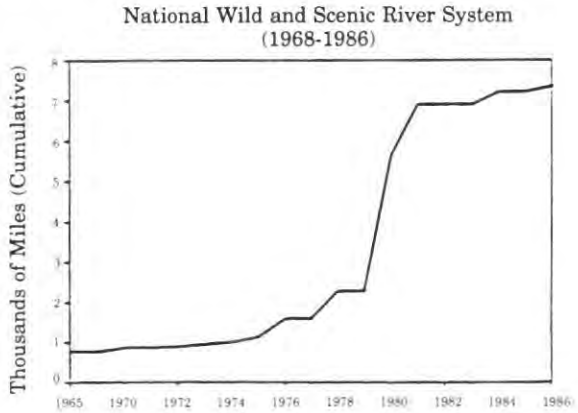
Selected Trends in Environmental Real Estate Acquisition

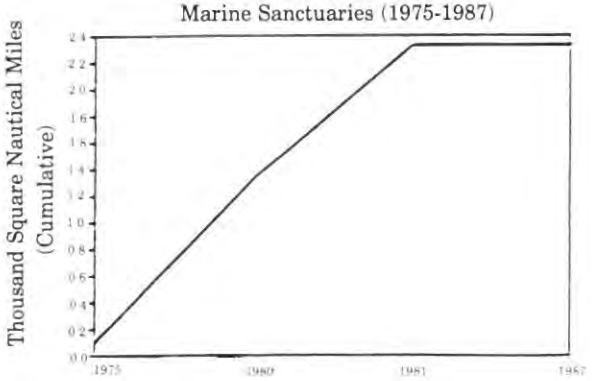












Source: Council on Environmental Quality: Environmental Trends 1989.

Designated inventory has grown significantly since the late 1960s, as the escalation in acquisitions of real estate by public agencies suggests and the proliferation of conservation land trusts implies (see Exhibit 1). Undesignated inventory is dynamic; it loses acreage to designation but gains acreage as society continues to develop and pollute and, in turn, create new categories of land that need protection.

Supply in a regulatory context also may be distinguished as real estate-specific (a specific parcel like Yellowstone Park is protected) or attribute-specific (attributes like endangered species' habitats or ecosystems are protected wherever they may be found and so, in effect, is the real estate they occupy).

Supply may be distinguished further by classes of attributes: geographic, hydrologic, biologic, archaeologic or historic types. Each of these classes has many subclasses. The biologic class, for example, includes species and ecosystems; the hydrologic includes oceans, lakes, rivers, streams, waterfalls, groundwater, etc. Within the geographic class are mountain ranges, canyons, buttes, etc.; within the archaeologic class are ancient burial grounds, ruins, etc. The historic class includes battlegrounds, the birthplaces of famous persons, etc..

Note: Certain types of environmental real estate supply (e.g., pristine lands or endangered species' habitats) can be destroyed and lost permanently (sometimes called the effect of irreversibility). However, much polluted environmental real estate supply can be rehabilitated, and many environmentally significant attributes may be introduced at new locations.[5]

While a full quantitative accounting of the environmental real estate supply is beyond the scope of this article, partial figures hint at its magnitude: forests under Forest Service management equal 140 million acres;[6] privately owned wetlands potentially subject to regulatory protection total 70.3 million acres;[7] the National Park System holds 79 million acres;[8] the National Wilderness Preservation System holds 79 million acres;[9] National Wildlife Refuges have 90 million acres;[10] wild and scenic rivers extend 7,363 miles;[11] marine sanctuaries cover 2,200 square nautical miles;[12] the National Estuarine Research Reserve System has approximately 390,000 acres;[13] and the National Historic Register has nearly 47,000 places.[14] Excluding the rivers, marine and estuarine reserves, which may or may not have disposable property rights, and historic places for which acreage was unavailable, a partial inventory of federally protected environmental real estate totals a staggering 458.3 million acres or approximately 20% of the surface area of the United States. If the habitats of endangered species, and lesser holdings of the Bureau of Reclamations, Bureau of Land Management, etc., were tallied, the figure might increase dramatically. States own another 154 million acres of real estate. Assuming a protection ratio similar to that of the federal government (.44),[15] state-owned environmental real estate may be as high as 67.8 million acres.

A distinguishable supply of environmental real estate clearly exists. The supply is massive; it is increasing in size; and it is segmented into attribute and use types by regulations that result in designated, undesignated and tertiary markets. Ownership, although heavily concentrated in agencies of the federal government, is divided among many public and private sector entities. Of course, the federal government is a significant landowner in more traditional real estate markets as well.

Distinguishable Characteristics Of Demand

Demand may be distinguished as an individual need (e.g., user fees for experiencing parks) or the collective need of society expressed through acquisitions by public agencies, land trusts, wildlife organizations and, to a lesser degree, for-profit corporations and individuals. These demand sources buy, trade and, in the case of public agencies, land trusts and wildlife organizations, accept donations. Demand tends to move ownership of environmental real estate not only from the private to the public sector but also among public agencies (interagency transfers), land trusts and wildlife organizations.

Demand may be distinguished by the intended use of property. Generic categories of use include experiencing environmental real estate, preserving land for a highest and best use to be determined later, conserving land to maintain the environment or exploiting specific resources such as oil, timber, gold, etc..[16]

Demand may be distinguished further by the intended users of property, i.e., individual users (hikers), collective users (the government) and future users.

Individual demand for use of environmental real estate has escalated rapidly. In 1965, approximately 100 million visitors experienced the national parks. By 1986, the number of visitors increased to approximately 350 million. Collective demand appears to be increasing also,[17] although comprehensive figures of the dollars spent by the government for acquisition of environmental real estate are not available. The recent defeat of the Big Green initiative in California and the Environmental Quality Bond Act in New York do suggest, however, a limit to the public's willingness to subsidize the protection of environmental real estate. Because these proposals involved unprecedented sums of money and, in the case of Big Green, controversial collateral political issues, it is unclear whether voters are losing interest in environmental protection, are alienated by collateral political issues or simply want governments to spend less.

Specific public sector organizations that acquire environmental real estate include federal agencies (primarily the National Park Service, the Fish and Wildlife Service and the Forest Service), public agencies of the 50 states (one or more acquiring departments per state), and thousands of regional districts, counties and municipalities. Private sector organizations include over 900 conservation land trusts operating across the United States, which own approximately 2.7 million acres in 48 states,[18] certain wildlife and wilderness organizations and philanthropic foundations. An undetermined, but

probably less significant number of private individuals and corporations also participate.

Tracking the monies spent on environmental real estate is a topic for another article, but a few random observations may provide some perspective. According to Craig D. Hungerford, a consultant specializing in environmentally significant lands: $3.6 billion of the Federal Land and Water Conservation Fund has been expended since 1964; California appropriated $770 million for environmental real estate in 1989; the Nature Conservancy budgeted $29.6 million for acquisitions of environmental real estate in 1987; and the Trust for Public Land had conveyances of lands totally $362 million in market value for the 15-year period prior to 1990.[19] Rhode Island (a $147 million budget) and Dade County Florida (a $100 million budget) also are appropriating significant monies for parks and open space acquisitions, as is Michigan, which allocates approximately $100 million per year for such acquisitions. The state of Florida recently appropriated $3 billion dollars for acquisitions of environmental real estate over the next ten years.

Organizations active in the environmental real estate market may acquire properties individually or in alliance with others. Alliances may take the form of interim buyer/end buyer (a land trust buys property and resells it to a public agency), cofinancier (various organizations pool funds) or adjoining purchases (individual organizations buy individual parcels of a protected area).

In conclusion, a distinguishable demand in environmental real estate exists. The demand is large, increasing and varied in source, like many real estate markets. Unlike most real estate markets, the demand for environmental real estate is extraordinarily concentrated in the public sector. However, public sector demand dominates other accepted real estate markets (e.g., elderly and low-income housing).

Facilitation Of Pricing

A contemporary real estate market acts as a pricing mechanism, i.e., it is a means for people with money and want and people with goods to agree on a price in a transaction. In a market, transactors allow their individual notions of the worth of a good to be influenced by a consensus on price which has been formed on the basis of a number of recent transactions and offers for similar goods—in a spatial context or market area.

From the perspective of markets as pricing mechanisms, transactors of environmental real estate routinely consider what has been paid and offered for other environmental real estate when making their transaction decisions. Hence, transactors of environmental real estate exhibit behavior that is typical of transactors in other contemporary real estate markets.

Facilitation Of Supply

A contemporary real estate market facilitates supply, i.e., it varies production of supply according to scarcity (due to increased demand or perceived decrease in unprotected supply), as demand increases (which tends to stimulate supply) or decreases (which discourages supply), assuming a constant cost of production, as one example.

From the perspective of a market as a supply facilitator, one finds significant evidence that the supply of environmental real estate (protected attributes of the environment) has increased significantly since the late 1960s. In the last 30 years, demand for environmental real estate has increased, along with environmentalism's surge,[20] in popularity (see Exhibit 1) and the perception by influential elements of society that pollution and development have reduced the amount of unprotected environmental real estate to undesirable levels.

Presence Of Government Regulation And Subsidy

Considerable governmental regulation and subsidy are typical of most contemporary real estate markets. Regulation and subsidy are used by society to produce a desired supply of real estate at desired locations and prices under the assumption that unregulated real estate markets will fail to do so within acceptable time frames.

Environmental real estate-related transactions and transactors *are* significantly shaped by regulation that prevents alternative development, which may otherwise outbid environmental real estate uses. They also are affected by government subsidy for the acquisition and use of property as environmental real estate. Governmental regulation and subsidy of the market for environmental real estate is analogous to governmental regulation and subsidy of low-income housing markets: i.e., without regulation, neither market would produce the desired supply at desired prices in desired locations; therefore, the government intervenes to foster, locate, shape and stimulate the markets.

Implications Of Recognizing An Environmental Real Estate Market

The body of environmental real estate transactions fits the definition of a market and exhibits the characteristics of a contemporary real estate market. It follows, therefore, that a comparable sales properly drawn from the environmental real estate market constitute valid indications of market value.

Several significant implications beyond admissibility of comparable sales also flow from recognition of an environmental real estate market. They are:

1. Environmental real estate probably will be increasingly viewed by society as a monetized environmental property having significant market value; it will be viewed less as an aesthetic natural resource having marginal market value.
2. The market value of environmental real estate, at any given time, will depend significantly on supply and demand factors in the market as they are perceived by transactors.
3. As society allocates more money to the conservation of environmental real estate, society can expect market mechanisms to increase supply and/or raise prices.

4. When supply is not consistent with demand, price inflation may be expected.
5. As with other monetized real estate assets in markets with stable to increasing demand, environmental real estate can expect development (i.e., the systematic application of skills and capital by organizations to increase revenues and/or market value) and speculation (i.e., opportunistic exploitation of supply/demand relationships by investors).

   Implications 2, 3, 4 and 5 are subjects for further research because, collectively, they suggest a real estate asset that is well-suited to valuation, development, underwriting and management by traditional real estate principles of appraisal, enterprise science finance and investment.

Summary

Increasing acquisitions of environmentally significant lands, in particular, negotiated purchases involving public agencies, raise a valuation question: do they constitute a market? Assuming they do, properly drawn sales of environmental real estate involving public agencies should be valid indices of market value. Further, public agencies' policy of encouraging the use of condemnation valuation methodology should be stopped, unless public agencies intend to condemn and sellers acknowledge that the possibility of condemnation will alter significantly their negotiations.

According to analysis, environmental real estate-related transactions and transactors constitute a contemporary real estate market because they are consistent with a basic market definition; they have identifiable supply and demand; they facilitate pricing and supply; and they are subject to significant governmental regulation and subsidy. Essentially, the environmental real estate market is people and organizations with money who price and facilitate the supply of property that will be used for conservation, rehabilitation and introduction of environmentally significant attributes according to people's wants but subject to governmental regulation and subsidy.

Recognition of an environmental real estate market brings with it several significant implications. Comparable sales properly drawn from the environmental real estate market should constitute valid indications of the market value of the real estate. There will be a tendency to view environmental real estate more as a monetized environmental asset with a significant market value that is subject to influences of supply and demand and less as an aesthetic natural asset with marginal market value.

Ultimately, a perceived scarcity of desired environmental real estate, plus increasing demand for it, likely will attract more governmental regulation, development and speculation to a market process aimed at supplying demand, attracting revenues and enhancing market value. For society, public agencies, relevant decision-makers and real estate counselors to assess effectively planning, acquisition and valuation decisions, it is appropriate to recognize the environmental real estate market, admit appropriate comparable sales involving public agencies and sensitize participants in the market to the supply/demand factors that influence the value of environmental real estate.

NOTES

1. No statistics have been found to indicate the ratio of conservation lands acquired by condemnation vs. those acquired by negotiated purchase.
2. Graaskamp, James A. *Fundamentals of Real Estate Development* (Washington, DC: Urban Land Institute, 1981) 3.
3. Bell, Martin L. *Marketing Concepts and Strategies, 3rd ed.* (New York: Houghton Mifflin Company, 1979) 108.
4. One submarket might be citizens who acquire wetlands through public agencies in California. Another might be citizens who acquire large-area ecosystems through not-for-profit corporations in the Upper-Michigan peninsula. Another might be direct acquisitions by citizens of wilderness/grazing habitat near Yellowstone National Park, etc..
5. See an informative discussion of restoration in Berger, John J. (ed.) *Environmental Restoration: Science and Strategies for Restoring the Earth* (Washington, DC: Island Press, 1990).
6. Council on Environmental Equality and Interagency Committee on Environmental Trends. *Environmental Trends* (Washington, DC: U.S. Government Printing Office, 1989) 87.
7. Ibid, 100.
8. Ibid., 115.
9. Ibid., 117.
10. Ibid., 116.
11. Ibid., 117.
12. Ibid., 118.
13. Ibid., 118.
14. Ibid., 119.
15. 458.3 million protected acres divided by 720 million federally owned acres.
16. Wilson, Donald C. "Basic concepts of environmental real estate development," *Colloquium on Establishing Environmental Values in Land Appraisal* (Rapid City, South Dakota: Western States Land Commissioners Association, Summer 1989 Conference).
17. According to *Land Use Digest* (Washington, DC: The Urban Land Institute, Nov, 1989), land acquisition programs are on the rise nationwide, as state and local governments buy property and development rights to preserve open space, provide more parks and save farmland from urbanization. Private land trusts have been growing throughout the 1980s, but the entry by government agencies is relatively new. Interest in the Northeast has been intense, where states and localities have committed over $1 billion in public funds to such programs, including Vermont's new $3 million housing and land conservation program and Suffolk County, New York's $300 million commitment to preserving watersheds. California's Proposition 70, a $770 million land acquisition bond issue that was passed last year, includes $63 million earmarked for the purchase of agricultural property rights. Libertyville Township, Illinois, has acquired more than 700 acres of land through an open space district. (California Planning and Development Report, Sept. 1989; Torf Filton Assoc., 1275 Sunnycrest Avenue, Ventura, CA 93003).
18. "Attractive land parcels gain a powerful ally," *Wall Street Journal*, May 28, 1991, *Section B*, p. 1.
19. Hungerford, Craig D. "Colloquium on establishing environmental values in land appraisal (Rapid City, South Dakota: Western States Land Commissioners Association, Summer 1989 Conference).
20. Other major surges of environmentalism (or conservation) occurred during the administration of Theodore Roosevelt and on the heels of the Dust Bowls of the 1930s.

THE VALUATION OF CONTAMINATED PROPERTIES

Four case studies reveal the methods of determining value for properties subject to toxic contamination.

by Peter J. Patchin, CRE

The vast majority of the literature on the valuation of properties subject to toxic contamination deals with regulatory background and valuation theory.[1,2] The field has progressed to the point that numerous actual hands on valuation cases have been experienced. It is the objective of this article to share four case studies taken from actual valuation experience. The cases concentrate on "in ground" contamination because it is the writer's opinion that several good "in building" valuation case studies have been published elsewhere.[3]

When one enters into the field of environmental appraising, he encounters a whole new vocabulary of terminology. A brief list of environmental terminology is set forth in Exhibit I.

Case Study A

This case study deals with a toxic contamination problem that causes a delay in the utilization of the highest and best use of undeveloped land.

Sam Farmer, and his father before him, operated a 50-acre vegetable farm at the outskirts of Big City, U.S.A., for the last 40 years. About ten years ago, the Super Charged Electronics Company, a subsidiary of a larger multinational firm, located a printed circuit manufacturing plant directly across the road from Sam's land. Sam observed his neighbors selling off property over the past few decades and was well aware of development land values in his neighborhood. Sam's land was one of the few remaining larger undeveloped parcels in the neighborhood.

Last year, he signed a purchase agreement with a major, well-financed development firm that intended immediately to develop the site. Sam was pleased with the $20,000 per acre sale price, for a total price of $1 million for his 50 acres. The development company, in accordance with the lenders who would finance the development, retained an environmental consultant in order to comply with the due diligence requirements of the 1986 Superfund amendments.

Sam was shocked and dismayed when the development company decided not to close the purchase agreement because toxic contamination had leaked from the printed circuit plant to Sam's land. Environmental tests disclosed that a combination of toxic contaminants from Super Charged Electronics had leaked into the ground water and migrated under about two acres of his land. Sam protested that this land was only a "little bit contaminated" and wondered why the buyer couldn't develop the remaining 48 acres.

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Exhibit I

Glossary of Environmental Terminology

ACM	Asbestos containing materials
AHERA	Asbestos Hazard Emergency Response Act of 1986
Attenuation layer	A layer of earth between contaminated soils and the drinking water aquifer
CERLCA	Comprehensive Environmental Response Compensation and Liability Act approved 1980 and called the Superfund Law
Environmental Consulting Reports	
Class I	The preliminary report that investigates the history of the subject and the neighborhood
Class II	The actual testing of the site which includes the monitoring of wells, probes of soil, etc., and their analysis
Class III	The engineering study of the means of correction (remediation) of the site, including estimates of the costs and time involved
EPA	Environmental Protection Agency, may be state or federal
HRS	Hazardous ranking score; a means of quantifying the public health risk of Superfund sites
Mortgage discrimination	The reluctance of lenders to become involved with a contaminated property even after cleanup is completed
Impaired value	The value of a property subject to toxic contamination
PPB	Parts per billion; also expressed as micrograms per liter (ug/l)
PPM	Parts per million; also expressed as milligrams per liter (mg/l)
PCL	Pico curies per liter; a measure of radon contamination
RAL	Recommended allowable limit for a specific contaminant; expressed in PPB or PPM
Remediation	The process of contamination cleanup
SARA	Superfund Amendments and Reauthorization Act of 1986; best known for its innocent purchaser exemption which requires due diligence
Stigma	Those losses in property value over and above the costs of cleanup or remediation
Unimpaired value	The value of the property without consideration of its toxic contamination

Efforts to sell the land to other developers failed as soon as mandatory disclosure of the contamination was made. Sam therefore retained the services of a law firm to file suit against the Super Charged Electronics Company for loss in property values. You are retained to estimate this loss in value.

Your investigation reveals the following facts and/or conclusions:

1. The unimpaired value of the site is $20,000 per acre or a total of $1 million.
2. State laws prevent the subdivision of lands that have a history of toxic contamination until cleanup has been completed and approved by the state's EPA.
3. A review of the environmental studies conducted on both Super Charged Electronics Company property and Sam's land reveals a substantial cleanup cost which Super Charged Electronics has agreed to assume as part of the cleanup of its own site. Engineers' reports indicate that three years is the minimum reasonable time that should be allowed for cleanup before the local EPA could be expected to render its approval.
4. The highest and best use development of Sam's land will require over $5 million in borrowed capital. The size of the development indicates that the most likely market for financing would be larger regional banks and/or insurance companies. A survey of these lenders reveals a marked reluctance to lend on a property such as Sam's, even after cleanup has been completed. It appears that only a few of the qualified lenders will even consider the project. Consequently, these lenders will be able to name their price within reasonable limits. The best estimates are that lenders will call for about a 3/4% risk premium on the loan. The going mortgage terms are 10% interest, 30-year amortization with a balloon payment in ten years.
5. The yield for development land in the area is about 12%. Market research indicates that the market value will grow at 3% per year.
   The land yield rate is the total anticipated investor return. If the sale of the land is deferred for three years, its owners should receive a price that is 1.03^3 times current market value.

Thus:	1.03^3 =	1.0927
	x 3 years present worth factor @ 12%	0.7118
	Net deferred factor	0.7778

6. Future monitoring costs on Sam's land, as required by the EPA, are estimated to be $5,000 per year, with no time limit given.
7. Agricultural ground rent is $100 per acre pre year, with the lessee required to pay taxes.

Question
What is the value of Sam's land, assuming that Super Charged Electronics will pay for the cleanup?

Solution

Unimpaired value		
50 acres @ $20,000/acre =		$1,000,000
Less: Losses in value from the time delay for development		
3 years factor @ 9% =	0.7778	
Thus: 1,000,000 × 0.7778 =	$777,800	
Or $1,000,000–$777,800 in time loss =		($222,200)
Monitoring cost @ $5,000/year capitalized @ 9% (yield-growth)		($55,556)
Interim income (agriculture)		
50 acres @ $100.00 @ 3 years 12% factor or $5,000 × 2.2832 =		$11,416
Mortgage discrimination:		
Borrowed capital	$5,000,000	
Difference in mortgage constants between 10% & 10 3/4% mortgage	× .0067	
Extra mortgage payments	$33,500/year	
Assume balloon payment in 10 years		
Present worth of excess mortgage payments @ 10% mortgage rate for 10 years $33,500/year × 6.144 (10% = 10-year present worth of one/annum factor.) =		($205,824)
Indicated net value of site as contaminated		$522,219
Indicated loss in value due primarily to stigma factors		$477,781
Unimpaired value		$1,000,000

Case Study B

This case study deals with a toxic contamination problem that forces a change in the highest and best use of undeveloped land.

For purposes of brevity, this case study uses the same parcel of land that was described in Case Study A. The contamination situation, however, is quite different and may be described as follows:

1. The source of the contamination is located on an adjacent property and is far more serious than found in Case Study A. This contamination source has been designated as a definite public health threat by the state EPA and has been assigned a hazardous ranking score (HRS) of 55, which qualifies the neighboring site as a national Superfund site. (HRS of 28.5 or above qualifies a property as a Superfund site). Cleanup of this property may take ten years or more, and it is not clear at this time if cleaning the site down to its recommended allowable limits (RAL) is even feasible.
2. Extensive environmental tests on the Sam Farmer site to date have revealed only trace amounts of the contaminants found on the adjoining Superfund site; all readings have been below RAL. Because the groundwater flows in the direction of Sam's land, the state EPA will require continued monitoring of the site for an indefinite period.
3. All efforts to sell Sam's property to developers have failed upon mandatory disclosure of the neighborhood's history. Prospective buyers cite lack of financing for development as well as the undesirability of locating next to a Superfund site as reasons for refusing to consider Sam's property.
4. Inquiries with lenders indicate no interest in lending on the property. Lenders state that the possibility of the contaminants migrating under Sam's land is reason enough for not becoming involved.
5. The only interest in the land has been expressed by few local building contractors who are not willing to buy the land but are willing to lease it as a building materials storage site, at a net rent of $1,000 per acre per year.
6. The market capitalization rate, as indicated in Case Study A, is 9.0%. However, there are additional risks of owning this property due to cleanup costs and market stigma. The owner of the property from which the contamination originates is a large, well-financed corporation, and it is unlikely to assume cleanup costs. A review of what little market data exists indicates that after cleanup and financing problems have been handled, a residual discrimination of 20% to 30% of value remains.

Question
What is the value of Sam's land now?

Solution

Unimpaired value		
50 acres @ $20,000/acre =		$1,000,000
Impaired value		
Net rent (50 acres @ $1,000) =	$50,000	
Vacancy & credit allowance @ 10%	$5,000	
Effective rent	$45,000	
Less: Monitoring costs	$ 5,000	
management	$1,000	
Net income	$39,000	
Capitalization rate		
Market rate	9.00%	
Risk premium @ 25% additional	2.25%	
Impaired capitalization rate	11.25%	
Impaired value:		
$39,000 ÷ .1125 =		$346,667
Indicated loss in value due primarily to stigma factors		$653,333

Case Study C

About 20 years ago, Joe Jobshop built an industrial plant to suit the needs of his small but growing manufacturing business. His plant was a good quality industrial building of 40,000 square feet located on a three-acre site that had been a real bargain—a former salvage yard site that Joe was able to purchase from a receiver in bankruptcy.

Last year, the plant's neighboring property was sold and, under due diligence as required by SARA, a small amount of groundwater contamination was found. Further environmental testing revealed that Joe's property was the source of the contamination. The nature of the contaminants indicated that the previous salvage yard operation was totally responsible for the contamination. After the nature of the contamination problem was revealed in the news media:

- Joe's business banker informed him that his credit line for accounts receivable, inventory and the like would be discontinued. The banker expressed fears about contingent liabilities arising from environmental cleanup costs that could possibly bankrupt Joe, whose business was not particularly good at the time.
- Several of Joe's best customers inquired about the contamination problem and asked if Joe could continue to be a viable supplier. His largest customer stopped doing business with him.
- Efforts failed to obtain replacement business financing. Two bankers responded, in writing, that environmental concerns were their reason for refusing.
- Joe has decided to declare bankruptcy.

You have been retained by the receiver in bankruptcy to express an opinion of market value of the impaired property. Your investigation reveals the following facts and conclusions:

1. The unimpaired market value is $25.00 per square foot of gross building area or $1,000,000.
2. Environmental testing indicates that the cleanup of both Joe's and the neighbor's property would cost $2,000,000. The state EPA has agreed to an alternative, however, that will allow cleanup efforts to cease at ten times RAL for a cost of "only" $250,000. (The neighbor's site would be cleaned to less than one times RAL.) This cleanup would take about three years; because the remaining contamination is ten times RAL, monitoring will have to continue indefinitely at an estimated cost of $5,000 per year.
3. A survey of lenders indicates that there is little, if any, chance of mortgaging the property now or in the future. Most of the lenders commented that "ten RAL may be OK with the state EPA but not with us."
4. There is still a strong interest in renting the subject property at a market net rent of $120,000 per year. The prospective tenants do not want to be in the chain of title, however.
5. The normal capitalization rate for unimpaired industrial properties similar to Joe's is 10 1/2%. As part of this capitalization rate, a 16% equity yield appears to be reasonable. The property at present has a nonassumable mortgage with a balloon payment coming due next year. This mortgage also contains a due-on-sale clause.
6. The risk premium, inherent in the future ownership of this impaired property, is estimated to be 5%. The potential liability to adjoining property owners is a major factor. It should be noted that this risk premium is approximately twice as great as the risk premium in Case Study B, which did not involve liability to adjoining property owners.

Question

What is the value of Joe's plant?

Solution

Unimpaired value		
40,000 square feet of gross building area		
@ 25.00/square foot		$1,000,000
Impaired value		
Net rent (per year)	$120,000	
Less: Vacancy & credit allowance @ 10%	$12,000	
Effective net rent	$108,000/Yr.	
Less: Monitoring costs	$5,000	
management	$2,000	
Net income	$101,000	
Capitalization rate		
Mortgage 0% × .10 =	0.0000	
Equity 100% × .16 =	0.1600	
Appreciation/depreciation	0.0000	
Risk premium	0.0500	
Indicated overall rate	0.2100	
Indicated impaired value:		
$101,000 ÷ .21 =		$480,952
Less clean-up cost to ten RAL		$250,000
Net impaired value		$230,952
Say		$230,000

The indicated loss in value may be allocated as follows:

Cost of cleanup	$250,000
Stigma factors	$520,000
Total loss in value	$770,000

Case Study D

This case study uses the same property that was described in Case Study C but reverses the positions of Joe and his neighbor: the neighbor's land is the source of contamination; Joe's property has only small amounts of contamination.

Joe's business was so strong he had been planning to move to a larger plant and had signed a purchase agreement for his old property. Everything was going well until the buyer's due diligence investigation revealed the contamination. Since then, the buyer has notified Joe that the deal was off; further efforts to sell the property have been unsuccessful; Joe's attorney has filed suit against the owner of the neighboring property.

You have been asked to testify as an expert witness regarding the diminution in Joe's property value due to the contamination. Your market research indicates the following:

1. A mortgage will not be available on the subject property until cleanup has been completed. Sale of the property at the present time requires seller financing at rates competitive with the general mortgage market. Such financing terms are estimated to be 10% interest, 75% loan to value, 25-year amortization with a five-year balloon payment. Annual debt constant is 0.10944.

2. The subject property will suffer mortgage discrimination after the cleanup is complete. Such discrimination is estimated to be 1/2 of 1% interest. Considering future mortgage discrimination, as well as other stigma factors, it is reasonable to assume that a contract buyer will demand at least an 11% overall capitalization rate versus the market's 10.5% rate.

Question

Assuming that any physical cleanup costs will be paid as a first priority by the neighboring property owners, what is the value of Joe's property?

Solution

Probable price with seller financing:		
Net operating income (Same as Case Study C)		$101,000
Capitalization rate	11.0%	
Indicated selling price: $101,000 ÷ .11 = $918,182 Say		$920,000
Probable terms:		
Cash down: $920,000 × .25 =		$230,000
Contract for deed: $920,000 × .75 = $690,000 principal balance × .109044 = annual payment		$75,240

In this case, the seller has been forced to substitute a mortgage rate of 10% for his equity yield of 16%. In addition, the seller retains a certain amount of risk due to the contamination itself. A risk premium of 2% is selected because the risk is minimal; the subject is not responsible for the contamination itself or that of surrounding properties. The total equity yield, as contaminated, therefore is 18%.

The present worth of the subject property, with its existing owner, may be measured as follows:

		Cash Equivalent
Cash down		$230,000
5 Years of payments @ $75,240/year × 3.127 (5 year factor @ 18%) =		$235,275
Present worth of balloon payment		
Principal amount	$690,000	
Principal reduction @ 0.0584 =	$40,296	
Balloon payment	$649,704	
5 year reversion factor @ 18%	× .4371	$283,986
		$749,261
	Say	$749,000
Thus:		
Unimpaired value		$1,000,000
Impaired value		$745,000
Indicated diminution		$251,000

Summary

The foregoing case studies clearly illustrate that the nature, extent and circumstances of environmental contamination have the greatest influence upon the final value of a property. Quite obviously, there is no quick fix or rule of thumb in estimating the market value reduction.

The major problem encountered in environmental analysis is the lack of available market data. The difficulty in assembling market data is that the sales that did not occur often are more important than the ones that did. Knowledge of the reasons why a particular contaminated property could not be sold frequently indicates the methodology for its valuation. As market data expand to include efforts to sell and/or finance environmentally contaminated real estate, more precise valuation techniques will be developed.

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RATIONALIZING ENVIRONMENTAL CLEANUP

In the difficult economic environment of the 1990s, rational, common sense approaches are needed for determining when and how environmentally contaminated sites should be cleaned up.

by Maurice Freedman, CRE

There is no question that the lives of those who establish the potential developmental value of tracts of land have become extremely complex over the past several years. In determining the "highest and best use" of land, we must consider not only traditional market and zoning variables but also the rapidly eroding "matter-of-right" for the legal use of the land itself. In a sense, the regulatory climate governing the use of land is in transition. The ultimate determination of land use is coming increasingly under the aegis of regulators and the community, rather than remaining solely at the discretion of the landowner. Although this shift in control is often difficult to reconcile with our society's assumptions about the vested rights of the landowner, it is a reality nonetheless. It is this author's opinion that, with the heightened public awareness of often legitimate environmental concerns, individuals' property rights will continue to erode in the foreseeable future, and this erosion will complicate the tough economic realities of the 1990s that confront both developers and the communities in which they strive to build their projects.

Environmental Trends

In forecasting the developmental potentials of a large tract of land over time, the rules by which the development game is played are not static but, in fact, are ever changing. Thus, the pursuit of the highest and best use of land is much like duck hunting: in order to hit the target, one must establish an adequate lead and shoot at a point where it is hoped both the bullet and duck will converge. To establish such a lead in development planning, one's finger must be on the pulse of the regulators and the community-at-large not only to learn what their attitudes are now but to anticipate accurately what those attitudes are likely to be six months or a year or more in the future.

Another reality one must acknowledge is the universality of the environmental movement. Stringent wetlands regulations, initiated in Massachusetts in the late 1970s with the Hatch and Jones Acts, have been adopted in almost every other state, and many of these same principles have been mirrored in federal wetlands regulations. A review of two decades of regulation governing the alteration of wetlands clearly shows a pattern of escalating stringency: first allowing reasonable use, then use for only limited purposes, then no use and finally no use of wetlands *and* a substantial fringe buffer zone of uplands surrounding the wetlands. Today, serious discussions are underway to decide whether to restrict the use of uplands which some day *might* become wetlands as ocean tides rise due to global warming.

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Other espoused concerns of the populace, such as "preserving the character of the community" or NIMBYism (not in my back yard), also are eroding the rights of property owners. Jack Kemp, Secretary of the U.S. Department of Housing and Urban Development, recently has documented the inordinate cost and time burdens associated with often redundant and sometimes extremist environmental regulations and the degree to which these regulations interfere with the attainment of another vital social goal—"affordable housing."[1] In spite of this governmental outcry, it is unlikely that current trends will change significantly.

Hazardous And Toxic Wastes

An even greater threat dwarfs all other concerns about the economic use of land: the financial liability that even an innocent landowner assumes with the purchase of property contaminated by one of the numerous substances on the U.S. Environmental Protection Agency's (USEPA) long list of hazardous materials.[2] With the invention and widespread use in the 1970s and 1980s of the atomic mass gas chromatograph spectroscope and other state-of-the-art technology, it has become possible to detect minute traces (parts per billion) of substances that may (or may not) be harmful to mankind. Proving with any degree of scientific certainty that a causal relationship exists between the presence of certain substances and the degradation of community health is often difficult, if not impossible.

Federal and state legislation labels trace amounts of certain substances as harmful and makes the landowner financially responsible for cleaning up those substances (even if the landowner in no way contributed to the presence of the hazardous or toxic substances or even knew about it at the time of purchase of the land).[3] It is now possible for the USEPA and state environmental regulators to legally attach *any* of the assets of the landowner as security for the cleanup costs, even if these costs are many times the value of the real property itself.

As the truly staggering costs of cleanup operations are becoming apparent, some members of the scientific community, cognizant of the need for reasonably and rationally prioritizing scarce financial resources, are suggesting that a healthy dose of common sense could save tens of millions of dollars, and permit dollars spent on costly cleanup operations to be reallocated to more urgent needs of much greater community benefit.[4] In the highly publicized Woburn case, which USEPA's regional administrator Julie Belaga called "the single largest settlement in the history of the Superfund cleanup program," a $69 million commitment was made by W.R. Grace and three other companies to an effort for purifying groundwater on a contaminated site which could take 20 to 50 years.[5] However, what public health imperative justifies an attempt to purify the groundwater in Woburn, which has been ably and amply served by other water sources since the groundwater contamination was identified in 1979? Further, since Metropolitan Boston, a region which includes Woburn, enjoys over 40 inches of rainfall annually and can readily serve its static population from the Metropolitan District Commission's (MDC) chain of surface reservoirs, what is the anticipated future use of Woburn's purified aquifer 20 to 50 years hence? Since the MDC is presently contemplating costly water treatment facilities which could be far more rapidly amortized by a larger usage base, it would be much more cost effective to connect to the MDC system those homes in Woburn which, previously had obtained their potable water from municipal or private wells rather than spend $69 million to clean up an aquifer which is not vital for meeting the needs of the community. The MDC system could provide Woburn with totally safe water supplies well into the 21st Century. Because of MDC's clearly demonstrated water conservation methods and the reduction in demand for its water supply from the state's declining industrial base, MDC's reservoir supply should be adequate for the foreseeable future.

Rationalizing Groundwater Policy

Hydrogeologists acknowledge that, while the contamination of groundwater is an extremely slow process (migration of the pollutant plume in the ground is often calculated in terms of only a few dozen feet per decade), groundwater pollution, once it occurs, is virtually irreversible. It is unfortunate that the American society, through decades and centuries of carelessness, has despoiled most groundwater resources in its urban areas. However, it is futile public policy to risk using inherently unsafe urban groundwater or to undertake costly, and no doubt fruitless, efforts at its cleanup.

Nineteenth century visionaries in cities such as New York and Boston anticipated problems with groundwater. By securing, in perpetuity, tens of thousands of acres of rural land and committing them exclusively to watershed protection, these visionaries created systems that would assure adequate and safe water supplies for their cities' rapidly growing populations. It has long been the position of this author that, in rural areas, where groundwater supplies may be significant and uncontaminated, it is not only vitally important but also practical to establish regional aquifer protection districts that will ensure the quality of critical water resources.[6]

Recently, the New Jersey Department of Environmental Protection (NJDEP) classified its groundwater resources into four categories. The lowest category, Class IV, covers extensive, already contaminated urban and industrial areas with groundwater that is not fit for human consumption and that generally is of poor quality. NJDEP prohibits use of Class IV groundwater for at least 50 years, thereby curtailing futile and costly attempts at its cleanup.[7] It is hoped that such practical and cost-effective solutions will become much more widespread over time.

Rationalizing Priorities For Site Remediation

Privatization of site remediation, which allows licensed and highly qualified geotechnical firms to undertake the cleanup of contaminated sites, will

reduce dependency on overworked and bureaucratic government officials and offer the opportunity for rapid, creative and cost-effective solutions to remediation of contaminated sites. The decision to permit private sector intervention occurs during a process known as "risk assessment". This process is performed after rigorous three-dimensional investigation of the site soils and groundwater by excavations, borings and chemical and biochemical analyses to determine the extent and causes of pollution and the specific nature and concentration of the contaminants. Once these basic facts have been ascertained, it is vital for the environmental scientist and the real estate counselor to explore the interplay between projected site cleanup costs (such costs are never known until the work is complete) and the value of alternative potential land uses. It is necessary for both parties to engage in a free-flowing, give-and-take discussion and determine creatively the true highest and best use of the land in such complex cases. The participants in this exercise must be highly qualified and seasoned experts in their respective fields, and they must be able to provide sound judgments and reliable, if rough, quantifications of cost and value relationships so that a reasonable and appropriate strategy for land use can be established.

Many real estate investors are aware of horror stories concerning the zillions of dollars spent for remediation. The costs of remediation in fact range from the simply modest to the truly horrendous, and they depend largely on the nature and degree of contamination. For example, costs for air stripping of certain petroleum volatiles often are in the range of a few thousand dollars per acre; costs for cleaning up high concentrations of toxins such as cyanide, polychlorinated biphenols or mercury, which typically entails the removal and detoxification of the soil and groundwater, can run to tens of millions of dollars per acre. Costs of remediation also depend on the nature of the land use. The residential land use category demands the highest level of remediation, but an alternative land use, such as certain industrial and commercial facilities, may require only that the soil be sealed with an impervious membrane or a layer of clay.[8]

An innovative method of remediation was utilized by the Hackensack Meadowlands Development Commission to deal with a noxious and odorous landfill in the infamous New Jersey Meadowlands. In this case, the landfill was "turned into fields of wildflowers after the ground was covered with a synthetic liner made from recycled bottles".[9] The commission presently operates a trash museum and environmental center immediately adjacent to this once detested landfill.

Conclusion

As a society, we are facing limitations on our financial resources. The mounting national debt, now above $3 trillion; increasing worldwide economic competition from the European Community and the Pacific Rim nations; failures of major banks and diminishing governmental support for all sectors are some of the unpleasant realities with which we must grapple. With the increase in our environmental awareness and the discovery of greater than formerly realized soil and groundwater contamination, we, as a nation, must set rational priorities for our environmental cleanup efforts. It is essential to:

- protect uncontaminated groundwater by establishing regional groundwater protection districts
- acknowledge hopelessly contaminated or unsafe urban groundwaters and write these off once and for all (or until technological advancements make their cleanup economically viable)
- intensify research into techniques for cost-effective groundwater and soil decontamination when the chemistry of the responsible pollutant or the particular situation are appropriate for remediation
- establish protocols for appropriate land uses on sites with contaminated soil and groundwater
- encourage the licensing of qualified professional firms to carry out remediation efforts economically and efficiently

A Word Of Advice

As a real estate investor or analyst, do not be frightened or intimidated by the need to address rationally and practically ever more difficult and complex land valuation situations. Make sure that you have highly qualified, practically minded and experienced scientists and professionals to help you with the tough business decisions and tradeoffs which you, of necessity, will be facing now and in the future.

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