NONSTRUCTURAL APPROACHES TO FLOODING AND WATER QUALITY CONTROL

by James B. Blackburn, Jr.

Nonstructural control techniques are becoming increasingly important as federal, state, and local levels of government attempt to understand more fully the available alternatives for the control of flooding and nonpoint sources of water pollution. As used in this paper, "nonstructural" does not refer to a lack of physical alterations in the natural system, but rather to regulatory or legal control of land development by government. For example, a retention pond required for subdivision plat approval would be a nonstructural alternative involving an alteration of the natural system. The emphasis here is on the use of the subdivision plat approval process for flood control instead of on the physical alteration *per se*.

This discussion of alternative types of nonstructural controls will focus upon general types of solutions. Nonstructural controls may dictate the location, the form, and even the timing of land development activity. If we assume that a technical correlation exists between certain types of land development and adverse water quality or flooding effects, the control of the location and form of land development may offer the most practical and least expensive manner of alleviating the problem.

In the sections that follow, two basic approaches will be presented. First, mechanisms to control the *location* of development will be addressed. Second, alternatives to control the *form* of development will be explored. The choice of one of the alternatives must be based on an overall concept of a desired end result, including the integration of the water quality and flood control programs with other community goals and programs.

CONTROLS UPON THE LOCATION OF DEVELOPMENT

Controls influencing the location of development include regulatory controls such as zoning, land or easement purchase programs, tax incen-

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tives, and infrastructure placement. For a locational control program to work, there must be a relationship between the problem being addressed and the location of land development activity. Although such a relationship is most easily documented for flood damage, the location of development affects nonpoint source pollution as well. Also, the governmental body imposing locational controls must decide the degree to which it will regulate private property without compensation or, alternatively, the degree to which it offers compensation. How it resolves the compensation question will ultimately determine the final cost of the solution pursued.

Regulatory controls

Certain levels of government are able to limit personal property rights in the interest of public health, safety, and welfare. The use of these regulatory controls is based upon the "police power."[1] State laws enable local governmental units to enforce police power controls such as zoning. If the regulatory control is too severe, the courts may be asked to determine whether there has been a "taking of property without due process of law."[2]

Zoning

Zoning became popular in this country near the turn of the century, and was upheld as being constitutional in the landmark case of *City of Euclid v. Ambler Realty Co.*, a 1926 U. S. Supreme Court case.[3] Once a state has given a particular level of government the power to enact a zoning ordinance, the implementing governmental unit identifies uses to which land may be put, based upon a comprehensive plan. This determination is codified in a zoning ordinance and exhibited on an official map. Subsequent land developers are required to comply with designations in the zoning plan.[4]

Zoning is often appropriate for the control of land uses within flood-prone areas. It addresses the problem of flooding directly; however, other problems develop in at least two areas. First, the owners of flood-prone lands will be limited in the value their property can command in the marketplace. In other words, zoning classifications determine land value. Second, the zoning process often is abused through the issuance of variances from the regulations. The variance process undermines the comprehensiveness of zoning and results in even greater inequity because certain land owners suffer fewer restrictions than others. Nonetheless, the zoning approach is a very powerful alternative for controlling where land development occurs, and it has been used extensively to prevent land development in flood-prone areas.

Open space zoning prevents total development of a watershed, thereby limiting the amount of urban runoff flowing into a stream or river segment.

This approach treats landowners outside of the floodplain unequally with respect to a similar situation, i.e., the generation of runoff.

Another alternative involves zoning impermeable soils for development and permeable soils for non-development. Although a scientific basis exists for the differential treatment (i.e., those areas that could accept water into the subsurface should be left in a natural condition), this approach is difficult to administer, and it could be costly to serve the resulting dispersed developments with necessary utilities.

To date, the most common use of zoning (in the context of this paper) has been to prevent or limit floodplain development.[5]

Transfer of development rights

Transfer of development rights avoids some of the equity problems often created by zoning.[6] Government may restrict the ability of certain persons to develop their land (e.g., floodplain zoning) and allow other landowners to develop their land if certain conditions are met. A central concept of this approach is the severance of the right to develop the land from the right of land ownership. This separation is common in other contexts. For example, mineral rights may be transferred even though the ownership of the surface is retained. The ownership of development rights is somewhat analogous to the ownership of a mineral right. The major difference between a development-rights transfer approach and a zoning system is the introduction of a commodity (development rights) into the zoning system.

Governments using this technique typically specify certain conditions for land development. Generally, minimal development is allowed without a transfer being required. If a landowner wishes to build at densities beyond those allowed, however, he must purchase development rights from landowners whose land has been designated undevelopable. The number of development rights purchased determines the ultimate density allowed. The system is characterized by negotiations among landowners, and its major strength is that landowners who have been restricted from development gain compensation from landowners who benefit from a zoning classification. Under a conventional zoning system, the owner of the restricted land receives nothing.

The applicability of development rights transfers is limited. This approach is most appropriate where a small land area is restricted and a large land area is developable. Applications to date have generally been limited to the preservation of historic buildings,[7] and potential applications exist in the protection of unique environmental areas such as the habitat of an endangered species.[8] Depending upon the size of floodplain lands, this approach could be applicable to floodplain zoning; if large land areas are considered flood-prone, it is doubtful that it would be practical.

Fee simple or easement purchase

A second group of techniques influencing location of land development includes fee simple or easement purchase programs. The governmental entity purchases either full title or an easement (negative servitude) to the subject lands. The major strength of this method is that it provides direct compensation to the landowner restricted in the use of the subject property, and the major weakness is that it requires the expenditure of public money, which may arouse controversy.

Fee simple purchase

Fee simple purchase involves the exchange of the land title for direct compensation. The exchange may take place on a willing-buyer/willing-seller basis, or it may be forced upon an unwilling seller through the use of the power of eminent domain and subsequent condemnation.[9] The purchase of fee simple title is most affordable with respect to floodplain lands if the land area that is flood-prone is small or if fee simple purchase is used as one of a number of alternatives. The program is expensive and it does remove land from the tax rolls. However, the purchasing entity may open such lands to the public. Therefore, the major benefit of this technique is the provision of public access.

Fee simple purchase has been used primarily in conjunction with multiple-use projects involving public recreation.[10] Linear parks and greenbelts have long been suggested as appropriate uses of flood-prone lands. The aesthetic benefits and water-oriented recreational opportunities of flood-prone lands are substantial; purchase may be used in conjunction with structural methods, thereby ameliorating some of their usually adverse aesthetic impact.[11] The use of this practice may be expected to expand as the cost of park land increases and the problems of restricting floodplain development become more severe.

Easement purchase

Purchasing a development easement—a land development right without an exchange of fee simple title[12]—represents a compromise whereby the owner of the land retains surface title and the right to continue certain specified uses without allowing public access. The landowner will lose the alternative of developing the land, however, with the extent of the restriction specified by the sale contract. Subsequent purchasers will also be bound by the easement. An easement purchase program is usually handled as a willing-seller/willing-buyer transaction, although the possibility exists that a development easement could be condemned.[13]

The development easement approach appears applicable to floodplains as well as to larger land areas within which a particular use is deemed desir-

able.[14] For example, agricultural lands in certain areas have a low potential for nonpoint source pollution, and they retain rainfall on site. If these lands were converted to residential or commercial uses, the nonpoint source loadings as well as the rate of runoff from these lands would be increased. Therefore, the purchase of a development easement would be one way to keep the land agricultural while compensating the landowner for such a restriction. The major shortcoming of this approach is that the public does not gain collateral benefits such as access. If public access is not deemed essential, the purchase of development easements is a workable alternative that will be less costly than fee simple acquisition.

Tax incentives

Administration of property taxes, in particular, ad valorem taxes, may offer inducements to landowners not to develop their property. The essence of this method is the taxation of property according to use value rather than market value. A landowner wishing to retain land in a certain use will not be forced to alter the use in order to pay property taxes based on a higher-valued use.

Tax incentives are applicable to lands that produce little runoff or nonpoint source pollution. The use value taxation technique has been used in some states to preserve agricultural lands.[15] It could be applicable to flooding and nonpoint source pollution controls, and it will seem more attractive if the tax policy has multiple goals (i.e., preservation of agricultural productivity, open space, or wildlife habitat, reduction of nonpoint source pollution, and rainfall runoff reduction may all be promoted by a single tax policy). Widespread use of such a policy will require a thorough tax base analysis, including a determination of property tax increases to be passed on to the remainder of the taxpayers not included within the use value exemption.[16] Tax policies do not prevent the conversion of land to other uses, but offer an inducement to retain a particular use.

Infrastructure placement

Selective placement of infrastructure known to stimulate land development (in particular, the location of sewer lines and sewage treatment plants, the delineation of their service areas, the provision of drainage, the provision of water, and the location of public roads) has a substantial influence upon where development occurs.[17] The location of these facilities is often made without consideration of their impact on development. A more comprehensive attitude toward these secondary environmental impacts is required for "all major federal actions significantly affecting the environment," but local and state infrastructure decisions often are not subject to such an analysis.[18] By carefully considering infrastructure placement, gov-

ernments can induce development in certain areas and discourage it in other areas.

Conclusion

A range of alternatives may influence where land development occurs. These vary from strong regulatory programs to incentive programs to compensation programs. All of these techniques may be applicable in a given locale *if* a relationship can be documented between the location of development and either nonpoint source pollution generation or flood damage. If a clear spatial relationship does not exist, then controls over the form of development may be more appropriate than controls over the location of development. In any case, these locational controls should be integrated with other land development or environmental considerations in order to avoid solving one type of problem while exacerbating another.

CONTROLS UPON THE FORM OF DEVELOPMENT

Controls upon how land is developed without regard to where such development occurs may involve a wide range of variables relevant to flood damage and nonpoint sources of pollution, including erosion controls, limitations on the rate of runoff generation, limitations on drainage infrastructure design, and other elements of the built environment, including density. Generally speaking, local governments may control the form of land development in three ways: zoning, subdivision plat approval, and issuance of building permits. Before determining the appropriate level or type of control, a governmental entity must consider whether prescriptive or performance controls will be used.

Performance controls and prescriptive controls

Initially, the governmental body wishing to control "how" development takes place can choose the type of regulatory system to be established. The control may specify exactly what the developer is expected to install in order to control a particular adverse impact (e.g., the use of hydromulching for erosion control), or it may require more generally that runoff from the site contain only a specified concentration of suspended solids (e.g., 30 p.p.m.), thereby allowing any technique to be used. The first example is a *prescriptive* control and the second example is a *performance* control.[19]

There are a number of positive and negative aspects of both types of control. Prescriptive controls are the simplest to administer. Once the determination has been made that a particular control should be used, the permitting authority merely reviews development plans to determine whether the required control is included. Little if any technical expertise is needed to administer the program. The weakness of this approach lies in its simplicity. By specifying the exact control to be used, the regulatory system may be

totally unresponsive to questions of cost and developer flexibility, not to mention specifics such as terrain differences within the jurisdictional area. In this manner, competition between developers may be limited, incentives for innovation may be removed, and least-cost techniques are unlikely to be used at each site.

The performance alternative appears preferable to a developer, but may be difficult to enforce administratively. It requires a higher level of governmental staff expertise. In practice, a developer may bring a set of plans to the governmental entity, stating the controls planned for the development and showing, in engineering terms, the effectiveness of the system with respect to the required degree of performance. The technical staff must then make an independent analysis of the efficiency of the program, to determine whether the system will, in fact, meet the performance standard. Since there are a number of variables that may be altered to control either runoff or nonpoint source pollution production, a large number of alternatives could be presented for governmental review. The strengths of the performance approach lie in the fact that the regulation does not limit a developer's options. In fact, cost incentives may be amplified and expanded. Therefore, performance regulations may be chosen for their sensitivity to cost and their ability to encourage innovative solutions.

Once the decision between prescriptive and performance controls has been made, a determination must be made concerning the proper legal mechanism for implementing the chosen system. A number of alternatives exist (that a local governmental unit may or may not be enabled to enact), varying in both spatial resolution and purpose.

Zoning

The applicability of zoning to the "how" of land development is more complex than the applicability of zoning to the "where" of land development. In particular, zoning classification must be tightly tied to a technical understanding of the nonpoint source pollution or flooding problem. The usual zoning classifications, such as single family or multifamily, could be useful because of variations in volume of runoff and types of pollutants. A more promising application of the zoning system may be to zone with respect to the desired level of adverse impacts (performance zoning).[20] In other words, rather than being zoned as single family, four dwelling units per acre, an acre might be zoned as nonpoint source category two, which would correspond to a predetermined performance standard.

This application of zoning may not be necessary. The specificity of control offered by zoning, although certainly variable, may in many instances be less than is desirable, and alternative legal mechanisms exist, offering a similar degree of control without requiring either the creation or alteration of a complex zoning ordinance. The successful use of zoning

seems most likely when a zoning system is already in operation. The most direct parallel with present zoning systems may be seen in classifications such as planned unit developments[21] rather than the more traditional land-use classifications. In other words, a traditional zoning system may be ill-suited to the control of nonpoint source pollution or excess runoff. Alternatives such as planned unit development offer flexibility in the mix of development types and open space necessary to achieve overall nonpoint source pollution control or runoff reduction. If no zoning program is in effect in the watersheds of concern, an alternative program influencing how development takes place may be established using subdivision plat approval and building permit issuance powers.

Subdivision plat approval

A second apparatus for governmental control may be found in the power of local governments to require approval of subdivision plats before construction begins.[22] These subdivision plats define the general layout of the subdivision, generally including information about the transportation and circulation system, the drainage system, the general land use plan, the water system, and the sewer system. Many of the potential variables for control of nonpoint source pollution and runoff are identified and reviewed in the subdivision plat approval process; therefore a nonpoint source pollution control program centering upon the subdivision plat approval process may be quite feasible.

Although either a performance or a prescriptive approach is potentially workable, the major distinction between the two appears in the mechanics of the subdivision plat approval ordinance. If a performance approach is adopted, the ordinance should set limits on volume and quality of stormwater allowed to flow from the site. The applicant would be required to document the engineering specifications and the design criteria that led to the proposal of a particular system. If a prescriptive approach is chosen, then the ordinance would state the specific alternatives the government requires. For example, the ordinance may require that retention ponds be built on a predetermined ratio basis (e.g., 5 retention pond acres for each 100 acres of developed land), or that only certain specified techniques be used. The important point at this stage of the analysis, however, is that *either* a performance or a prescriptive approach may be used in the subdivision plat approval process.

Building permit approval

A third level of regulatory control occurs at the individual dwelling or lot level. Most municipalities and many counties have passed ordinances controlling the types of materials permitted, as well as other aspects of building construction.[23] These programs often include the floodplain management criteria of building-slab elevation in addition to the more tradi-

tional building materials regulations. The lot owner must obtain a permit from the governmental entity before commencing construction. Further, the governmental entity usually checks to make sure that permit specifications have been met before allowing electrical service to be turned on at the building. The building permit system offers a very high degree of regulatory resolution, and certain nonpoint source pollution control and flood damage reduction alternatives could be implemented at this level. These alternatives, however, generally must be prescriptive rather than performance controls if the building permit process is to be relied upon *alone*. Although a building permit process could be performance-oriented, options for meeting performance criteria solely at the lot level are limited.[24]

Nonpoint source pollution or runoff may be controlled at the lot level by limiting the area or percentage of the lot that may be cleared or covered with impermeable surfaces, by requiring rooftop storage of stormwater, by specifying erosion controls to be used on a lot-by-lot basis, and by flood proofing. While these and other options may be part of a performance "package" proposed by a developer, the performance control must be administered at a regulatory level encompassing larger land areas. If certain controls at the lot level are prescribed, however, the building permit process can see to it that they are used.

Theoretically, the subdivision plat approval process and the building permit process are complementary and should be thoroughly integrated, whether the controls used are performance or prescriptive. For example, at the subdivision plat review, a developer would present an overall plan for controlling nonpoint sources of pollution. The plan may include retention ponds, natural drainage, or limitation of the amount of land area to be cleared for dwellings. If the overall plan is appropriate, the retention pond and the natural drainage system would be accepted through the formal recording of the plat with the governmental entity. The specifications relative to clearing on a lot-by-lot basis could be monitored through the building permit process. In other words, once the developer selects his performance system, the building permit process would offer a mechanism for determining whether the plan has been implemented according to the specifications submitted. If not, then an electrical connection would not be allowed. Similarly, if a prescriptive approach is pursued, the governmental entity may monitor certain aspects of the control plan at the subdivision plat level (e.g., retention ponds) and others at the building permit level (e.g., limits upon the amount of devegetation).

OTHER TYPES OF CONTROLS OR PROGRAMS

There are many variations on the basic implementation mechanisms described above. First, if a community has general ordinance-making

power, an ordinance could be written directly addressing the issue of concern. For example, an erosion control ordinance could describe either a performance or prescriptive approach for erosion control. Nonetheless, compliance would be monitored and enforced through either the subdivision plat approval or the building permit process. Septic tank controls could be passed, but again this ordinance would be enforced through refusal to issue a building permit or to record a subdivision plat if the stipulated controls were not installed.

Second, infrastructural design may influence "how" development occurs. For example, many counties and drainage districts widen and deepen natural channels. The power of eminent domain could also be used to condemn the land needed for a natural drainage system and retention ponds. This flood control or nonpoint source pollution control entity would thereby create the type of drainage infrastructure deemed desirable, and the developer would have to design the built environment to meet the design specifications of the drainage system. In this manner, the governmental entity gains the desired performance. While this approach may not be particularly attractive in areas utilizing very strong land-use controls, it may be very popular in areas where weak land-use controls exist. It would, however, be relatively expensive since natural drainage systems require considerably more land than conventional systems.

Third, direct expenditures can be made to solve pre-existing problems. For example, if flood proofing is deemed desirable, the building permit process could require such a program for future development. Naturally, dwellings constructed in the floodplain prior to the initation of such a program would not benefit from it. Therefore, the government could spend tax money to help these persons reduce flood damage and thus possibly reduce future requests from the landowners for governmental assistance.

Fourth, weather forecasting to alert residents when a major storm is approaching a flood-prone area could limit the total amount of damage from a flood.

CONCLUSION

A governmental entity wishing to use a nonstructural approach to either flood damage reduction or nonpoint source pollution control must review a wide array of legal mechanisms. The alternatives chosen must be within that governmental entity's legal authority, and a technical correlation should exist between the chosen approach and the desired result. Nonstructural approaches offer new challenges to all levels of government, but they often can yield the desired end result at a lower cost than would be possible using conventional methods. For this reason, the importance of these approaches will increase.

NOTES

1. E. Freund, *The Police Power, Public Policy and Constitutional Rights* (New York: Arno Press, 1976), p. 511.

2. Joseph Sax, "Takings and The Police Power," *Yale Law Journal* **74** (1964): 36. See also F. Bosselman, D. Callies, and J. Banta, *The Taking Issue* (Washington, D.C.: Council on Environmental Quality, 1973), chapter 9, pp. 147-155; and the article by Carol Dinkins in this volume.

3. 272 U. S. 265 (1926).

4. Zoning has been written on extensively. For an excellent treatment of zoning, see Daniel Mandelker, *Managing Our Urban Environment* (New York: Bobbs-Merrill, 1971), chapter 8, pp. 625-723.

5. Arnold Reitze, *Environmental Planning: Law of Land and Resources* (Washington, D.C.: North American International, 1974), pp. 69-71.

6. See Melvin Levin, Jerome Rose, and Joseph Slavet, *New Approaches to State Land-Use Policies* (Lexington, MA: Lexington Books, 1974).

7. John J. Costonis, "The Chicago Plan: Incentive Zoning and the Preservation of Urban Landmarks," *Harvard Law Review* **85** (1972): 574.

8. John J. Costonis and Robert DeVoy, "The Puerto Rico Plan: Environmental Protection through Development Rights Transfer" (Washington, D.C., Urban Land Institute, 1975).

9. Donald Hagman, *Urban Planning and Land Development Control Law* (St. Paul, Minn.: West Publishing Co., 1971), chapter 14, pp. 310-345.

10. Urban Land Institute, "Project Reference File: Indian Bend Wash Greenbelt Flood Control Project, Scottsdale, Arizona" (Washington, D.C., 1977). See also Bureau of Outdoor Recreation, "National Urban Recreation Study" (Washington, D.C., 1978).

11. One of the major alternatives available in providing "mitigation lands" that may be required under the terms of the Fish and Wildlife Coordination Act of 1958 is to integrate floodplain purchases into the structural project initially giving rise to the mitigation requirement. This approach may avoid questions relating to the federal government's policy concerning Section 73 of the Water Resources Act of 1974, which provides for 80% federal/20% local funding for nonstructural alternatives, but which has not yet been funded.

12. See William Whyte, *The Last Landscape* (Garden City, N.Y.: Doubleday, 1968).

13. See Hagman, *Urban Planning*, pp. 310-345.

14. Two of the major proponents of easement acquisition have been the U. S. Fish and Wildlife Service and the National Park Service.

15. P. G. Rowe, J. Mixon, B. A. Smith, J. B. Blackburn, G. L. Calloway, and J. L.

Gevirtz, *Principles for Local Environmental Management* (Cambridge, Mass.: Ballinger, 1978).

16. The passage in California of Proposition 13 underscores the importance of analyzing subsequent property tax impacts thoroughly.

17. Urban Systems Research and Engineering, "The Growth Shapers: The Land Use Impacts of Infrastructure Investments" (Washington, D.C., Council on Environmental Quality, 1976).

18. Under the National Environmental Policy Act. 42 U.S.C. Section 4321 et seq., 83 Stat. 852, Public Law 91-190, all "major federal actions significantly affecting the quality of the human environment" require issuance of an Environmental Impact Statement. Legal interpretations of this act as an environmental full disclosure law require both primary and secondary impacts to be analyzed. See J. B. Blackburn, "The National Environmental Policy Act and Secondary Environmental Effects with Case Study on Chocolate Bayou, Texas" (M.S. thesis, Rice University, 1974). If the action is not federal, then local and state impact statement requirements may apply if the state has passed such an act.

19. C. Thurow, W. Toner, and D. Erley, "Performance Controls for Sensitive Lands: A Practical Guide for Local Administrators," EPA publication #60015-75-00 (March 1975).

20. Hagman, *Urban Planning*, p. 119.

21. Ibid., pp. 431-460.

22. Ibid.,pp. 245-263.

23. See, for example, Southern Building Code Congress, *Southern Standard Building Code* (Birmingham, Alabama, 1973 ed. with 1974 amendments).

24. P. G. Rowe, J. L. Gevirtz, and J. B. Blackburn, "Natural Environmental Carrying Capacity and Building Regulation," in *Research and Innovation in the Building Regulatory Process* (Washington, D. C.: National Bureau of Standards, 1977).