United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240
April 19,1993

Honorable G. Edward Dickey
Acting Assistant Secretary (Civil Works)
Department of the Army
Washington, D.C. 20310

Dear Dr. Dickey:

In accordance with provisions of the December 21, 1992, Section 404(q) Memorandum of Agreement (MOA) between our agencies, I am requesting your review of the Vicksburg District (District) Engineer's decision to reissue General Permit 19(GP-19). GP-19 would authorize hydrocarbon exploration and production activities within the noncoastal portion of the District. I have determined that this case warrants elevation in accordance with criteria found in Part IV of the revised MOA (Elevation of Individual Permit Decisions). Reissuance of GP-19 will have substantial and unacceptable adverse effects on aquatic resources of national importance, largely because the District has failed to include adequate compensatory mitigation to offset project impacts.

While I do not object to a General Permit for hydrocarbon development activities, I am concerned that the District Engineer's decision to reissue GP-19, as proposed, is inconsistent with the purpose and intent of General Permit activities, as defined by Section 404(e)(1) of the Clean Water Act. It is my opinion that, despite the District's proposed compensatory mitigation, the proposed activity will result in more than minimal cumulative environmental impact to Federal trust fish and wildlife resources. The Department of the Interior (Department), acting through the Fish and Wildlife Service (Service), is vested with the authority to protect, conserve, restore, and enhance the Nation's fish and wildlife resources. These matters fall within our jurisdiction under the Fish and Wildlife Coordination Act, the Fish and Wildlife Act of 1956, the Endangered Species Act of 1973, as amended, the Migratory Bird Treaty Act, and Section 404(m) of the Clean Water Act.

Re-issuance of GP-19 will result in the loss of increasingly scarce forested wetlands within the Mississippi River Alluvial Valley (MRAV), which I have determined to constitute aquatic resources of national importance. Those forested wetlands are among the most productive habitat types in the United States; they support a vast array of fish and wildlife, including: resident and migratory waterfowl; other migratory birds, including neotropical migrants; game mammals; furbearers; amphibians and reptiles; and numerous freshwater fishes. The Louisiana black bear, a federally listed threatened species, inhabits forested wetlands in the permit area. Declining species abundance and diversity, exacerbated by habitat fragmentation and loss of dispersal corridors, have accompanied the loss of over 80 percent of the forested wetlands in the MRAV.

The activities regulated under GP-19 would not have substantial adverse impacts to aquatic resources of national importance if compensatory mitigation to fully offset those impacts was required. However, the District's compensation options are seriously deficient; consequently, adverse impacts will not be fully compensated. This unmitigated net loss of forested wetland habitat values represents a substantial and unacceptable adverse impact on a wetland type which has already experienced extensive losses. Accordingly, I have identified two primary areas of disagreement between the Department and the District for your consideration: 1) compensatory mitigation based on 1:1 replacement of the affected acreage, rather than full replacement of habitat values lost; and 2) a compensatory mitigation option based on payment of $300 per affected acre to an approved conservation entity.

Regarding the first issue, the Service provided the District with an assessment methodology, adapted from the Habitat Evaluation Procedures (HEP), to measure the quality of forested wetland sites and quantify compensation needs. That assessment procedure was developed cooperatively with regulatory staff from the New Orleans District over the past 2 years, and has been successfully used to quantify the impacts and compensation needs of regulated activities in that Corps District. However, in spite of its current use by another Corps District, and without a biologically sound rationale, the District rejected the Service's assessment methodology, stating only "[w]e believe that, in most cases, 1 acre of restoration/ reforestation for 1 acre of wetland functions and value impacted, in addition to site restoration, is adequate compensation." In contrast, the Service's HEP-based methodology indicates that the District's acre-for-acre approach will result in compensatory mitigation shortfalls of up to 65 percent when high value wetlands are affected and compensation would occur on public wildlife refuges. Moreover, Part III(B) of the 1990 MOA on mitigation between the Department of the Army and the Environmental Protection Agency specifies 1 to 1 functional replacement such that there be *no net loss of values*. The MOA only allows for 1 to 1 acreage replacement as a surrogate for no net loss of functions and values when more definitive information is lacking.

The second issue involves donating $300 per affected acre to an approved conservation entity for the purchase, restoration, or enhancement of wetlands. We recognize that this mitigation option represented an important first step in achieving compensation for habitat losses when the original General Permit was developed. However, this option has three major shortcomings. First, the amount donated is based on the acreage affected, not on the acreage actually needed to achieve full, in-kind mitigation (which should be determined by a habitat-based assessment of the impact and compensation areas over time). Second, the amount to be donated accounts for neither lost habitat value, nor the costs associated with acquiring, reforesting, and managing the compensation area. Those costs would likely exceed $750 per acre, based on existing costs for acquiring and reforesting suitable compensation lands. Third, Service discussions with Ducks Unlimited and the Tensas Conservancy Coalition revealed that GP-19 donations have not been used to purchase threatened forested wetlands, or to restore forested wetlands on cleared areas. I am particularly concerned that the District has failed to develop formal agreements with conservation entities to ensure that the forested

wetland values lost will be replaced in-kind, and that significant uncompensated losses of forested wetland habitat values will continue.

Finally, I also have concerns regarding the District's requirement that, for "...work on State or Federal Wildlife management areas, the applicant must obtain a certification from the managing agency....[f]ailure by the managing agency to respond or to request an extension for responding within 15 days shall constitute such certification." The Service cannot waive the statutory requirement for obtaining special-use authorizations for work on National Wildlife Refuges, except in those cases where judicial intervention has occurred. Accordingly, the Corps cannot dictate a 15-day concurrence deadline where Special-Use Permit authority exists.

In conclusion, I would not object to the reissuance of GP-19, provided that the District be required to include the following special conditions:

1. A habitat-based methodology, developed in consultation with the Service, shall be used to assess project-related impacts and determine the amount of compensatory mitigation needed for each authorized activity.

2. Contributions to conservation organizations, as well as any other forms of proposed compensation, will be limited to projects or funds dedicated to compensating for forested wetland habitat losses on private lands. Compensatory mitigation shall be approved in consultation with the Service prior to contribution. Contribution amounts must reflect the actual costs of accomplishing the necessary compensation work.

3. For regulated activities on State wildlife management areas or National Wildlife Refuges, managers of those lands shall be consulted by the applicant prior to permit application. The applicant shall provide documentation with the permit application demonstrating that the appropriate management agency's concerns (e.g., special-use authorizations, access routes, onsite restoration measures, and compensatory mitigation) have been satisfied.

Enclosures 1 and 2 provide additional information to substantiate the above concerns and recommendations as they relate to the proposed reissuance of GP-19. I request your review of the District Engineer's decision to reissue GP-19, based on the information used, and procedures followed, in reaching that decision.

Sincerely,

Thomas B. Williams

Acting Assistant Secretary for Fish
and Wildlife and Parks

Enclosures

ASSISTANT SECRETARY FOR FISH AND WILDLIFE AND PARKS' EVALUATION AND REQUEST FOR REVIEW

GENERAL PERMIT 19

PROJECT DESCRIPTION

The U.S. Army Corps of Engineers' Vicksburg District (District) is proposing re-issuance of General Permit 19 (GP-19) for hydrocarbon exploration and production activities affecting 5 acres or less. The permit would authorize work within the regulatory jurisdiction of the District, in noncoastal areas of Louisiana, Mississippi, and Arkansas. Authorized activities include the construction of access roads, mud pits, reserve pits, levees, and earthen mounds and fire walls associated with production facilities. The proposed GP-19 is a modification of a previous General Permit which authorized hydrocarbon activities affecting 1 acre or less.

AQUATIC RESOURCES OF NATIONAL IMPORTANCE

Forested wetlands, ranging from saturated and temporarily-flooded bottomland hardwoods vegetated predominantly with oaks, elms, and ashes, to semi-permanently flooded swamps dominated by baldcypress, comprise the aquatic resources of national importance affected by GP-19 activities. These wetlands occur within the Mississippi River Alluvial Valley (MRAV), including portions of Arkansas, Mississippi, and north and central Louisiana.

The MRAV once supported the largest expanse of forested wetlands in the United States. MacDonald et al. (1979) reported that, of the 24 million acres of forested wetlands which formerly existed in the MRAV, only 5.2 million acres (less than 22 percent) remained in 1978. Only 4.9 million acres were projected to remain by 1991, with 96 percent of this acreage occurring within Louisiana, Mississippi, and Arkansas. However, these states have also lost from 65 to 85 percent of <u>their</u> original forested wetlands (The Nature Conservancy 1992). Today, a large percentage of the remaining forested wetlands in the MRAV are publicly owned and managed for wildlife conservation purposes.

Forested wetlands are extremely important to the production of fish and wildlife in the MRAV. The periodic inundation of these floodplain wetlands makes them one of the most productive ecosystems in the United States (U.S. Fish and Wildlife Service 1979). Bottomland hardwoods typically support higher plant and animal productivity than adjacent upland habitats, as well as more abundant and diverse populations of many wildlife species (McKeever 1959, Glasgow and Noble 1971, Dickson 1988, Gosselink and Lee 1989, Harris and Gosselink 1989). Several fundamental habitat features characteristic of forested wetlands act together to support this abundance of fish and wildlife. These features include a diversity of hard and soft mast, presence of dens and cavities; high soil fertility; a diversity of food sources and cover types; presence of surface water and abundant soil

moisture; a dynamic flooding regime; interspersion of or proximity to permanent water sources; structural heterogeneity; and migration corridors (Wilkinson et al. 1987).

Seasonally inundated forested wetlands support extensive and diverse fish populations. During inundation, backwater and overflow wetlands within the MRAV provide important spawning and nursery habitat for a variety of sport and commercial fishes. Common species include largemouth bass, yellow bass, white crappie, black crappie, other sunfishes, freshwater drum, bigmouth and smallmouth buffalo, channel catfish, gars, carp, and bowfin (Lambou 1990, Hall and Lambou 1990).

A vast array of reptiles and amphibians inhabit forested wetlands; many of those species exhibit specialized life history adaptations enabling them to exploit a variety of flood conditions (Fredrickson 1978). The commonly associated species include lesser siren, amphiuma, bronze frog, cricket frogs, southern leopard frog, American alligator, cottonmouth, yellow-bellied water snake, mud snake, alligator snapping turtle, Gulf Coast box turtle, and eastern mud turtle.

A diversity of birds exploit numerous niches within forested wetlands throughout the year (Fredrickson 1978). Wading birds, waterfowl, raptors, woodpeckers, game birds, and passerine birds all utilize project-area forested wetland habitats. About 70 species of birds breed regularly in bottomland hardwood forests, and over 40 percent of those are neotropical migrant songbirds (Pashley and Barrow 1993). Many bird species are restricted to, or reach their greatest abundance in, forested wetland sites. Those species include barred owl, red-shouldered hawk, wood duck, yellow-crowned night heron, yellow-billed cuckoo, Acadian flycatcher, American redstart, prothonotary warbler, Swainson's warbler, and northern parula (Dickson 1978). The importance of MRAV forested wetlands to neotropical migrants is illustrated by work conducted by the Southeastern Working Group of "Partners in Flight" (part of the Neotropical Migratory Bird Conservation Program, a broad-based initiative to develop and implement research and management strategies for neotropical migrant birds). This work has demonstrated that, within the MRAV, 41 of the 55 neotropical migrant bird species studied are dependent on forested wetlands. Furthermore, 14 of those dependent species have tentatively been identified as needing special conservation attention. Forested wetlands within this region offer a variety of habitat features important to some neotropical migrants that are absent or poorly represented in other forested ecosystems, such as spanish moss, scour channels, baldcypress stands, and palmetto thickets (Pashley and Barrow 1993).

Temporarily, seasonally, and semi-permanently inundated forested wetland habitats within the MRAV also play a significant role in maintaining continental waterfowl populations. These areas are of particular importance to wood duck and mallard populations. Fish and Wildlife Service midwinter inventories (1955-1983) show that at least 22 percent of the United States mallard population and 50 percent of the Mississippi Flyway mallard population winter in the Lower Mississippi River Valley (Bartonek et al. 1984). The importance of that region's forested wetlands to wintering

mallards has been well documented by Fredrickson and Heitmeyer (1988). In addition, the permanently flooded swamps, oxbow lakes, rivers, and associated wetlands provide key habitat elements for breeding wood ducks. In recognition of the need to protect and restore critical waterfowl habitats, the Lower Mississippi Valley Joint Venture was established to help implement the North American Waterfowl Plan.

Temporarily flooded bottomland forests within the project area provide habitat that supports a variety of mammals, including game animals (white-tailed deer, swamp rabbit, eastern cottontail, gray squirrel, and fox squirrel). Important furbearers found in seasonally to semi-permanently flooded forested wetlands include mink, nutria, muskrat, river otter, and beaver, while gray fox, bobcat, raccoon, opposum and striped skunk typically inhabit saturated to temporarily flooded forested wetland areas.

The Louisiana black bear, a Federally listed threatened species (subspecies of the American black bear), occurs within the proposed permit area. This subspecies historically inhabited the forests of Louisiana, southern Mississippi, and eastern Texas; however, extensive land clearing has reduced its habitat by 80 percent (Neal 1992). At present, the Louisiana black bear's range is restricted to core populations within the bottomland hardwoods of the Tensas and Atchafalaya River Basins of Louisiana, and to small, scattered populations in Mississippi. The Louisiana black bear is dependent on the maintenance of large tracts of high quality bottomland hardwoods, as well as forested corridors to connect those tracts (Neal 1992).

In addition to providing important fish and wildlife habitat, forested wetlands serve many other valuable functions. Detritus and associated invertebrates (snails, insects, and crawfish) produced in forested wetlands contribute to the food web of productive downstream ecosystems (Harris et al. 1984). Forested and other wetlands store floodwater, thus protecting downstream areas from flood damage (Tiner 1984). Floodwater storage also allows for increased seepage of water into underlying soils, thereby replenishing available groundwater (Winger 1986). Odum (1978) indicated that forested wetlands improve water quality by removing excess nutrients and sediments from urban and agricultural developments before surface waters reach other aquatic environments. As noted by Gosselink and Lee (1989), the role of floodplain forests, including bottomland hardwoods, in water quality improvement has been addressed by many investigators. Forested wetlands also provide unique opportunities for recreation, education, and scientific research.

SUBSTANTIAL AND UNACCEPTABLE IMPACTS BASED ON INADEQUACY OF PROPOSED MITIGATION

Because the scope of the proposed activity is region-wide, the adverse impacts of authorization cannot be described on site-specific basis. Furthermore, the adverse impacts of GP-19 are cumulative in nature, and therefore more substantial than any single permitted activity. During the original 5-year term of GP-19, 267 actions affecting up to 1 acre each were authorized. The current proposal to expand the scope of GP-19 for work

affecting to up to 5 acres will significantly increase the potential for adverse impacts on forested wetlands of national importance. Evidence for this increase can be found in the fact that hydrocarbon activities proposed for authorization by the Vicksburg District as individual permits in Fiscal Year 1992 which would affect 5 acres or less accounted for over 291 acres in Louisiana alone. Of these, 39 percent of occurred on public lands managed for conservation purposes. With the proposed General Permit's increase in scope, virtually all hydrocarbon exploration and production can be developed in piece-meal fashion so as to qualify for authorization. Such actions have the potential to result in substantial direct cumulative environmental impacts, which, in the absence of adequate compensatory mitigation measures, would be contrary to the intent of Section 404(e)(1) of the Clean Water Act.

Regardless of the resource values involved, the activities to be authorized under GP-19 would not have substantial and unacceptable adverse impacts <u>if</u> in-kind mitigation to <u>fully</u> offset these impacts were implemented. However, the District's proposed mitigation options lack biological validity and are seriously deficient; consequently, adverse impacts will not be fully compensated.

The activities authorized by General Permit 19 are generally short-lived, yet their impacts to fish and wildlife habitat values are long-term. In most cases (i.e., 8 out of every 10 wells drilled), exploration results in nonproduction. According to the Louisiana Geological Survey, the average life span of a productive well in this region is 15 years. Whether a drilling activity is successful or not, well-site restoration typically involves fill removal and contour re-establishment within a few months of abandonment. At that point, limited wetland functional values (e.g., floodwater storage and groundwater retention) are recouped. However, full restoration of biological, physical, and chemical wetland values lost as a result of the original clearing activities will require decades of natural succession to return to a productive forested wetland.

Most often, light-seeded, wind-borne species such as green ash, American elm, black willow, and eastern cottonwood are the first to invade such disturbed areas; heavier seeded mast-producing species follow (Newling 1990). Hard mast species (oaks, pecans), considered the most valuable food producers for many forest-dwelling wildlife, do not begin seed production until they are about 20 years old. Optimum food production and development of nest cavities occurs when mast-producing trees are much older (i.e., 50 years).

The District's decision document states that the impact area "...will provide some habitat value as it succeeds into a mature forested wetland." That statement fails to recognize that decades will be required for such an area to provide the full spectrum of habitat values that it once contributed as a mature forested wetland. We also note that early successional wildlife species, such as white-tailed deer, have not shown the severe population declines experienced by many species dependent on mature forested wetland habitats (e.g., neotropical migrants and the Louisiana black bear). Moreover, activities regulated by GP-19 are more likely to adversely affect species that are sensitive to forest habitat fragmentation.

The Service has identified two basic areas of disagreement with the District's proposed permit decision: 1) compensatory mitigation based on 1:1 replacement of the affected wetland acreage, rather than full replacement of the habitat values lost, and 2) inadequacies associated with a compensatory mitigation option based on payment of $300 per affected acre to an approved conservation entity.

The first issue is the result of the District's narrow interpretation of Part III, paragraph b, of the 1990 MOA on mitigation between the Department of the Army and the Environmental Protection Agency. This provision requires 1 to 1 replacement of lost values and functions (i.e., measures of quality), except when "[i]n the absence of more definitive information on the functions and values of specific wetland sites, a minimum of 1 to 1 acreage replacement may be used as a surrogate for no net loss of functions and values." Since acres are primarily a measure of quantity, the Service provided the District with an assessment methodology, adapted from the Habitat Evaluation Procedures (HEP), that provides more definitive information on the habitat quality of forested wetland sites (see Enclosure 2 for a complete description of the results of this analysis).

A widely accepted habitat evaluation methodology, HEP has been extensively utilized by the Corps (including the District's Planning Division) and the Service for impact and mitigation assessments of civil works projects. This methodology accounts for changes in habitat quality and quantity that can be expected to occur over time, both with and without a development or mitigation action. The adaptation of HEP provided to the District was developed cooperatively with the New Orleans District Regulatory Branch staff over the past two years, and has been successfully used to assess the impacts and mitigation needs of regulated activities, including hydrocarbon exploration and production. However, the District has arbitrarily rejected this assessment, stating only "[w]e believe that, in most cases, 1 acre of restoration/ reforestation for 1 acre of wetland functions and value impacted, in addition to site restoration, is adequate compensation." In contrast, the Service's HEP-based methodology indicates that the District's acre-for-acre approach will result in significant compensatory mitigation shortfalls. As illustrated in Figure 1, a shortfall of up to 65 percent would occur when high-value forested wetlands are affected and compensation would occur on public wildlife lands. It should also be noted that the Service's habitat assessment methodology concludes that the District's acre-for-acre compensatory mitigation proposal will result in over-compensation in those extreme cases where impacts to lower quality wetland habitats are compensated on privately-owned and cleared wetland sites that would not increase in value over time. This situation is expected to occur rarely, since the added expense of compensating on privately-owned land makes this option economically undesirable.

Using the Service's HEP-based methodology, the impact of both short-term non-production and long-term production activities can be quantified (Figure 2). It has been demonstrated that compensation on public wildlife management areas and refuges (refuges) would require up to 2.87 acres of reforestation for every acre affected, compared to approximately 1 acre of required reforestation on privately-owned cleared wetlands. The larger

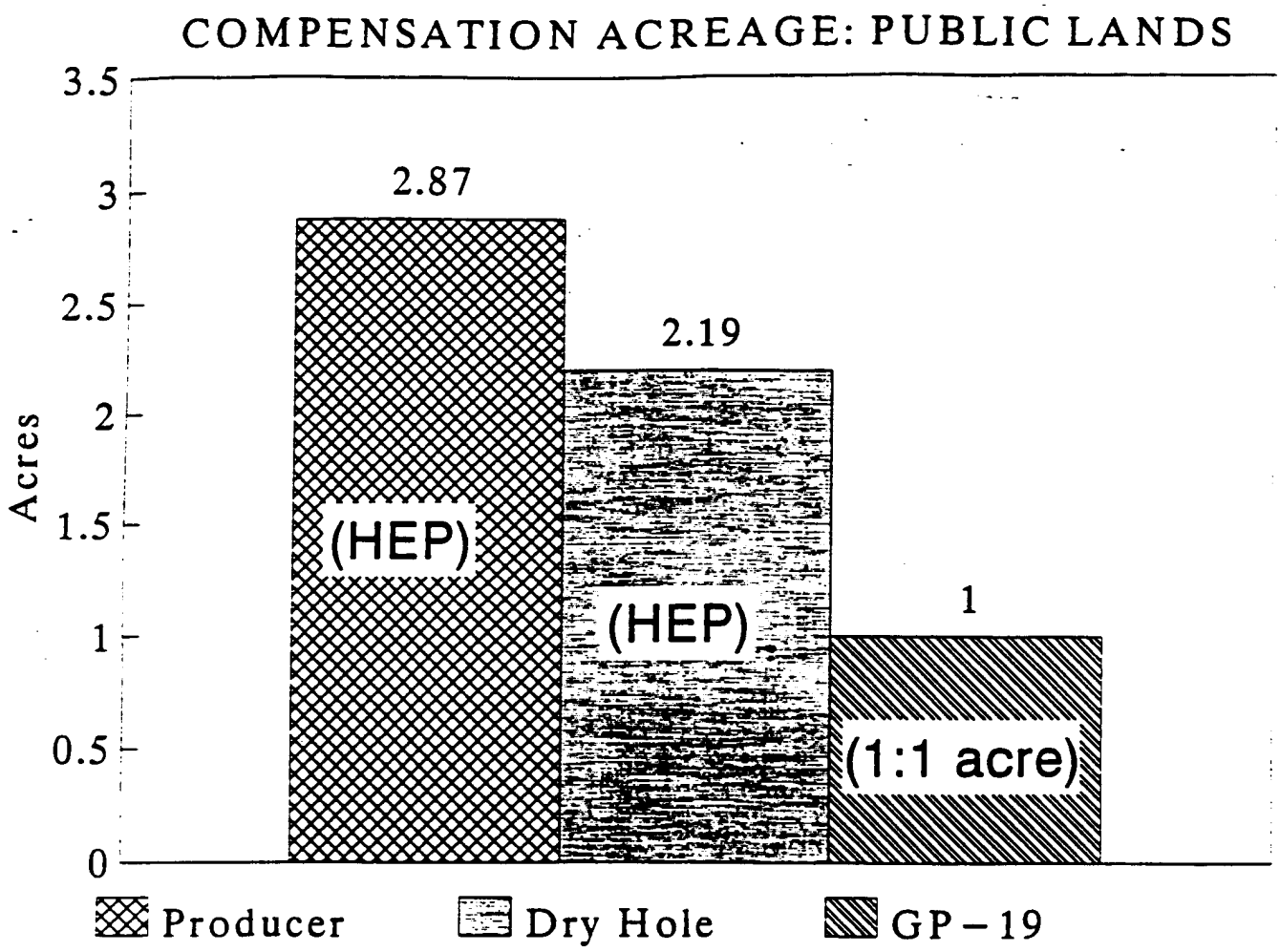


FIGURE 1. Comparison of compensation requirements for one acre of high value habitat when compensation is carried out on public refuge lands. Required compensation generated by Habitat Evaluation Procedures (HEP) for producing and nonproducing well scenarios is compared to the acre-for-acre approach proposed in GP-19.

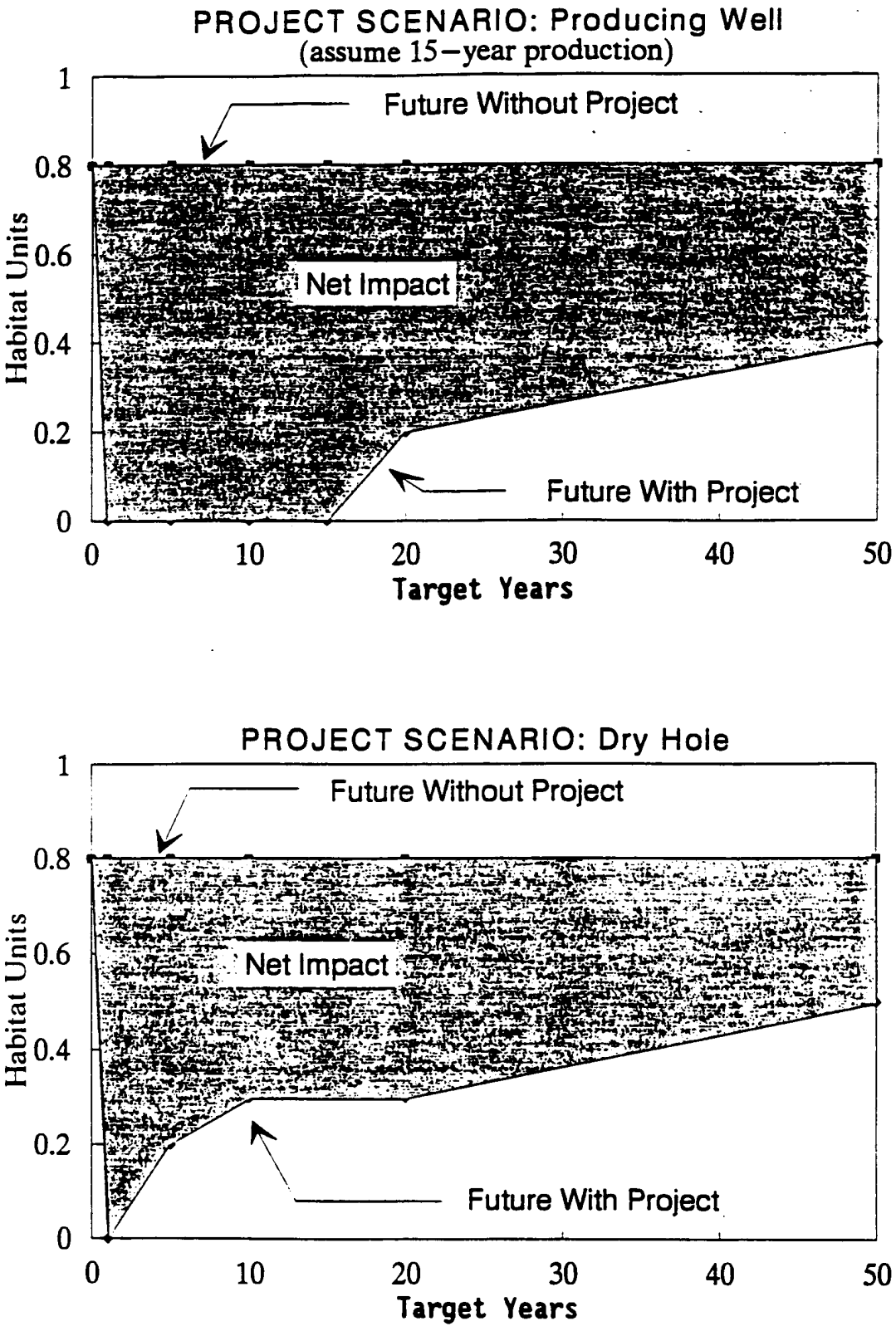


FIGURE 2. Modified Habitat Evaluation Procedures (HEP) assessment of future site conditions on one acre for both producing and nonproducing wells. Net impacts over time are expressed as the difference in habitat units (i.e., value to evaluation species) with and without the project for each scenario.

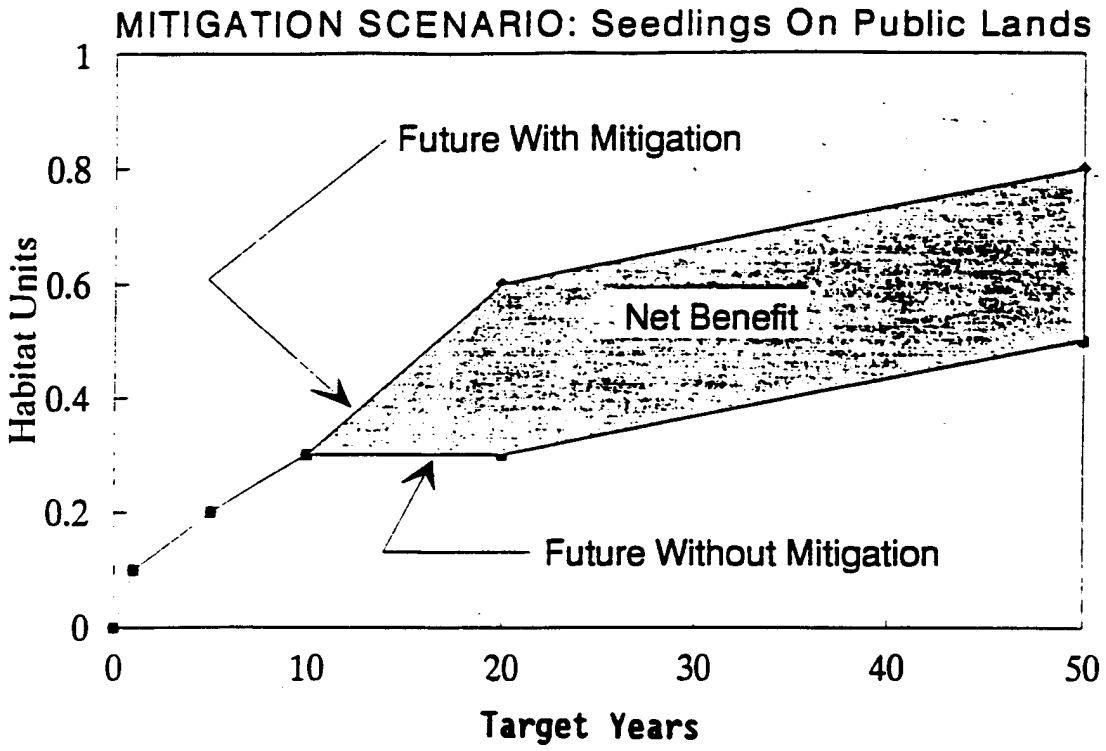
reforestation acreage is required on refuges because mitigation credit can only be given for the acceleration of wetland restoration on those lands (Figure 3). Even in the absence of compensation work, those lands would still increase in habitat value via natural succession or active management.

The District contends that full mitigation credit should be given to reforestation on refuges because "... the refuge managers can use the funds they would have spent on reforesting those areas in another part of the refuge." This argument is seriously flawed. Once funds have been "freed-up" from one activity (e.g., reforestation), they are often diverted from that activity, and many times they are diverted from the refuge altogether. Therefore, there is no guarantee that "freed-up" funds would be applied to activities related to wetland restoration.

The second issue of concern involves the donation of $300 to an approved conservation entity for each acre affected, and for which compensation can ultimately occur only on private lands. We acknowledge that this mitigation option, developed as part of a consensus-building process for the original General Permit in 1987, represented an important first step in compensating for unavoidable habitat impacts. However, viewed in the context of current mitigation practices, this option has three major shortcomings. First, the amount donated is based on the acreage affected, not on the acreage actually needed to achieve full, in-kind compensation, as determined by a habitat-based assessment of the impact and compensation areas over time. Secondly, the amount to be donated does not account for the true costs associated with acquiring, reforesting, managing, and maintaining private compensatory mitigation areas. Based on existing values for acquiring and reforesting suitable mitigation lands within the GP-19 impact area, those costs would likely exceed $750 per acre. It should be noted that the Louisiana Nature Conservancy has been interested in establishing a forested wetland mitigation bank; however, they realize that they cannot compete with public refuges, since they would have to pass the cost of land acquisition, management, and administration on to the mitigator, whereas those costs are government-subsidized on public lands.

Thirdly, and perhaps most importantly, Service discussions with Ducks Unlimited and the Tensas Conservancy Coalition revealed that none of the GP-19 donations have been used to purchase threatened forested wetlands, nor have such funds been used to restore forested wetlands on cleared areas. The Service is particularly concerned that the District has failed to develop formal agreements with conservation entities to ensure that the forested wetland values lost will be replaced in-kind.

In short, the District's donation alternative has no biological basis, falls well short of the funding needed to fully accomplish compensation, and is procedurally flawed, in that it does not ensure that the funds will be utilized to achieve in-kind compensatory mitigation within the GP-19 impact area. It is therefore apparent that, while private industry will continue to enjoy the benefits of rapid permitting, significant and uncompensated losses of fish and wildlife habitat values constituting aquatic resources of national importance will also continue.



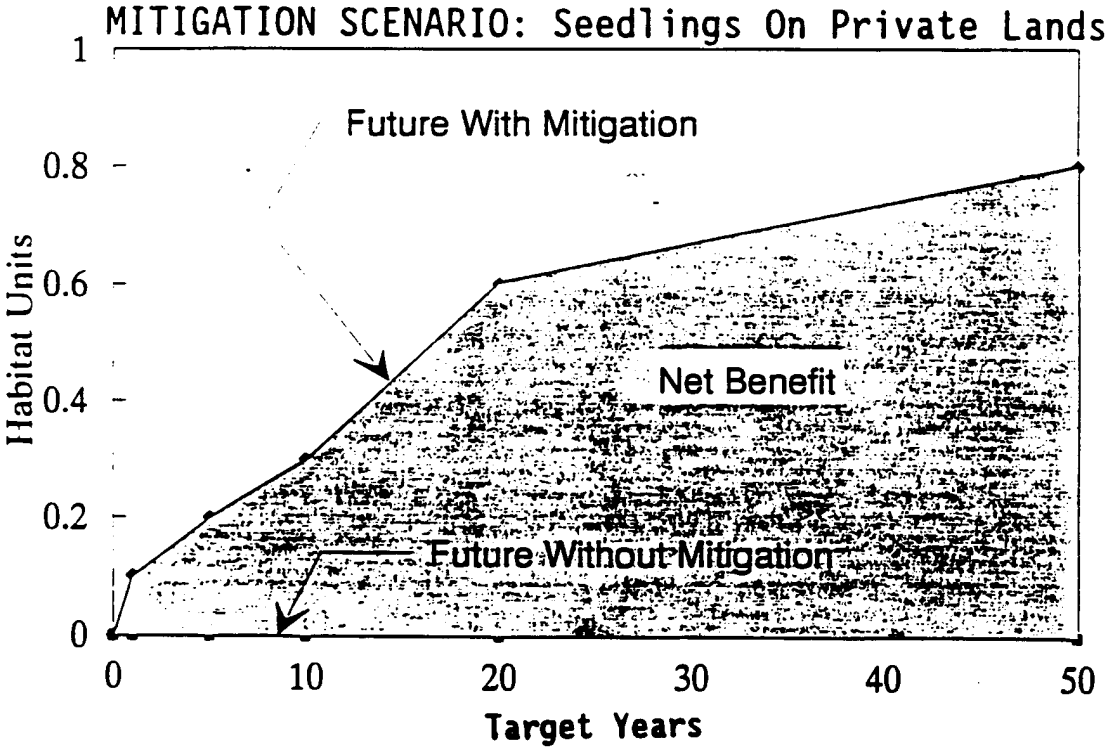


FIGURE 3. Modified Habitat Evaluation Procedures (HEP) assessment of mitigation credit generated for one-acre compensation sites on public refuge lands and private lands both with and without mitigation work. Public refuge land scenario assumes generation of habitat value over time regardless of mitigation work.

Finally, the Service also has concerns regarding the District's requirement that, for permitted "...work on State or Federal Wildlife management areas, the applicant must obtain a certification from the managing agency....[f]ailure by the managing agency to respond or to request an extension for responding with 15 days shall constitute such certification." The Service cannot waive the statutory requirement for obtaining special-use authorizations for work on National Wildlife Refuges, except in cases involving judicial intervention. Accordingly, the Corps cannot unilaterally dictate a 15-day concurrence deadline where Special-Use Permit authority exists.

Since GP-19 will clearly result in insufficient compensation for adverse impacts to important forested wetlands, the Service has concluded that re-issuance of that permit would result in substantial and unacceptable net adverse impacts to aquatic resources of national importance.

RECOMMENDATIONS

The Service does not object to re-issuance of GP-19, provided that full compensatory mitigation for the loss of forested wetland habitat values is required. To achieve that goal, the following special conditions should be incorporated in the General Permit:

1. A habitat-based methodology, developed in consultation with the Service, shall be used to assess project-related impacts and determine the amount of compensatory mitigation needed for each authorized activity.

2. Contributions to conservation organizations, as well as any other forms of proposed compensation, will be limited to projects or funds dedicated to compensating for forested wetland habitat losses on private lands. Compensatory mitigation shall be approved in consultation with the Fish and Wildlife Service prior to contribution. Contribution amounts must reflect the actual costs of accomplishing the necessary compensation work.

3. For regulated activities on State wildlife management areas or National Wildlife Refuges, managers of those lands shall be consulted by the applicant prior to permit application. The applicant shall provide documentation with the permit application demonstrating that the appropriate management agency's concerns (e.g., special-use authorizations, access routes, onsite restoration measures, and compensatory mitigation) have been satisfied.

REFERENCES

Bartonek, J. C., R. J. Blohm, R. K. Brace, F. D. Caswell, K. E. Gamble, H. W. Miller, R. S. Pospahala, and M. M. Smith. 1984. Status and needs of the mallard. Trans. N. Am. Wildl. and Nat. Resour. Conf. 49:501-518.

Dickson, J. G. 1978. Seasonal bird populations in a south central Louisiana bottomland hardwood forest. J. Wildl. Manage. 42(4):875-883.

_____. 1988. Bird communities in oak-gum-cypress forests. Pages 51-62 in Jerome A. Jackson, ed. Bird Conservation 3. Univ. Press, Univ. of Wis., Madison.

Fredrickson, L. H. 1978. Lowland hardwood wetlands: current status and habitat values for wildlife. Pages 296-306 in P.E. Greeson, J.R. Clark, and J.E. Clark, eds. Wetland Functions and Values: The State of Our Understanding. Am. Water Resour. Assoc., Minneapolis, Minn.

_____, and M. E. Heitmeyer. 1988. Waterfowl use of forested wetlands of the southern United States: an overview. Pages 307-323 in M. W. Weller, ed. Waterfowl in Winter. Univ. of Minn. Press, Minneapolis.

Glasgow, L. and R. Noble. 1971. The importance of bottomland hardwoods to wildlife. Pages 30-43 in Proceedings of the Symposium on Southeastern Hardwoods. U.S.D.A. For. Serv., Dothan, Ala.

Gosselink, J. G., and L. C. Lee. 1989. Cumulative impact assessment in bottomland hardwood forests. Wetlands 9:(special issue).

Hall, H. D., and V. W. Lambou. 1990. The ecological significance to fisheries of bottomland hardwood systems: values, detrimental impacts, and assessment (the report of the fisheries workgroup). Pages 481-531 in J.G. Gosselink, L.C. Lee, and T.A. Muir, eds. Ecological Processes and Cumulative Impacts. Lewis Publications, Chelsea, Mich. 708pp.

Harris, L. D., R. Sullivan, and L. Badger. 1984. Bottomland hardwoods: valuable, vanishing, and vulnerable. Fla. Coop. Ext. Serv., Gainesville, Fla. 16pp.

_____, and J. G. Gosselink. 1989. Cumulative impacts of bottomland hardwood conversion on hydrology, water quality, and terrestrial wildlife. Pages 259-322 in J.G. Gosselink, L.C. Lee, and T.A. Muir, eds. Ecological Processes and Cumulative Impacts. Lewis Publications, Chelsea, Mich. 708pp.

Lambou, V. W. 1990. Importance of bottomland hardwood forest zones to fishes and fisheries: the Atchafalaya Basin, a case history. Pages 125-193 in J.G. Gosselink, L.C. Lee, and T.A. Muir, eds. Ecological

Processes and Cumulative Impacts. Lewis Publications, Chelsea, Mich. 708pp.

MacDonald, P. O., W. E. Frayer, and J. K. Clause. 1979. Documentation, chronology, and future projections of bottomland hardwood habitat loss in the Lower Mississippi Alluvial Plain. U.S. Fish and Wildl. Serv., Ecological Serv., Vicksburg, Miss. 2 vols.

McKeever, S. 1959. Relative abundance of twelve southeastern mammals in six vegetative types. Am. Midland Nat. 62:222-226.

Neal, W. A. 1992. Threatened status for the Louisiana black bear and related rules. Final Rule, Federal Register, January 7, 1992. 50 CFR Part 17.

Newling, C. J. 1990. Restoration of bottomland hardwood forests in the Lower Mississippi Valley. Restoration and Management Notes 8(1):23-28.

Odum, H. T. 1978. Value of wetlands as domestic ecosystems. Pages 9-18 in J.H. Montanari and J.A. Kusler, eds. Proc. National Wetland Protection Symp., U.S. Fish and Wildl. Serv., Washington, D.C.

Pashley, D. N., and W. C. Barrow. 1993. Effects of land use practices on neotropical migratory birds in bottomland hardwood forests. In D.M. Finch and P.W. Stangel, eds. Status and Management of Neotropical Migratory Birds. U.S.D.A. For. Serv. Rocky Mtn. For. and Range Exp. Sta. Gen. Tech. Rep. RM:(in press).

The Nature Conservancy. 1992. An ecosystem in crisis: the forested wetlands of the Mississippi River. The Nature Conservancy of Louisiana, Baton Rouge. 23pp.

Tiner, R. S., Jr. 1984. Wetlands of the United States: current status and recent trends. U.S. Fish and Wildl Serv., Newton Corner, Mass. 59pp.

U. S. Fish and Wildlife Service. 1979. The Yazoo Basin: an environmental overview. Planning Aid Rep., U. S. Fish and Wildl. Serv., Ecological Serv., Vicksburg, Miss. 32pp.

Wilkinson, D. L., K. Schneller-McDonald, and G. T. Auble. 1987. Synopsis of wetland functions and values: bottomland hardwoods with special emphasis on eastern Texas and Oklahoma. Biol. Rep. 87(12), U.S. Fish and Wildl. Serv., Wash., D.C.

Winger, P. V. 1986. Forested wetlands of the southeast: review of major characteristics and role in maintaining water quality. Resour. Pub. 163., U.S. Fish and Wildl Serv., Washington, D.C. 16pp.

Enclosure 2

RESULTS OF FISH AND WILDLIFE SERVICE MODIFIED HABITAT EVALUATION PROCEDURES ANALYSIS OF COMPENSATORY MITIGATION NEEDS FOR GENERAL PERMIT 19

A modified Habitat Evaluation Procedures (HEP) analysis was performed by the Fish and Wildlife Service to assist the Corps of Engineers' Vicksburg District in quantifying impacts and compensation needs associated with General Permit 19 hydrocarbon activities. The results of this analysis are depicted in the following tables and figures (Sheets 1-17).

A 50-year projection of habitat quality for typical high, medium, and low value one-acre sites was assessed under with-project and without-project conditions, and for production and non-production (dry hole) scenarios. The net loss of habitat value indicates the compensatory mitigation deficit for each combination of site value and development scenario, and is shown both numerically and graphically.

In addition to impact assessments, reforestation compensation results on both private land and public wildlife refuges were projected over 50 years. The mitigation credit generated by reforestation and other management work is represented by the increase in habitat value, over and above the value attributed to the mitigation site under current management, or lack thereof.

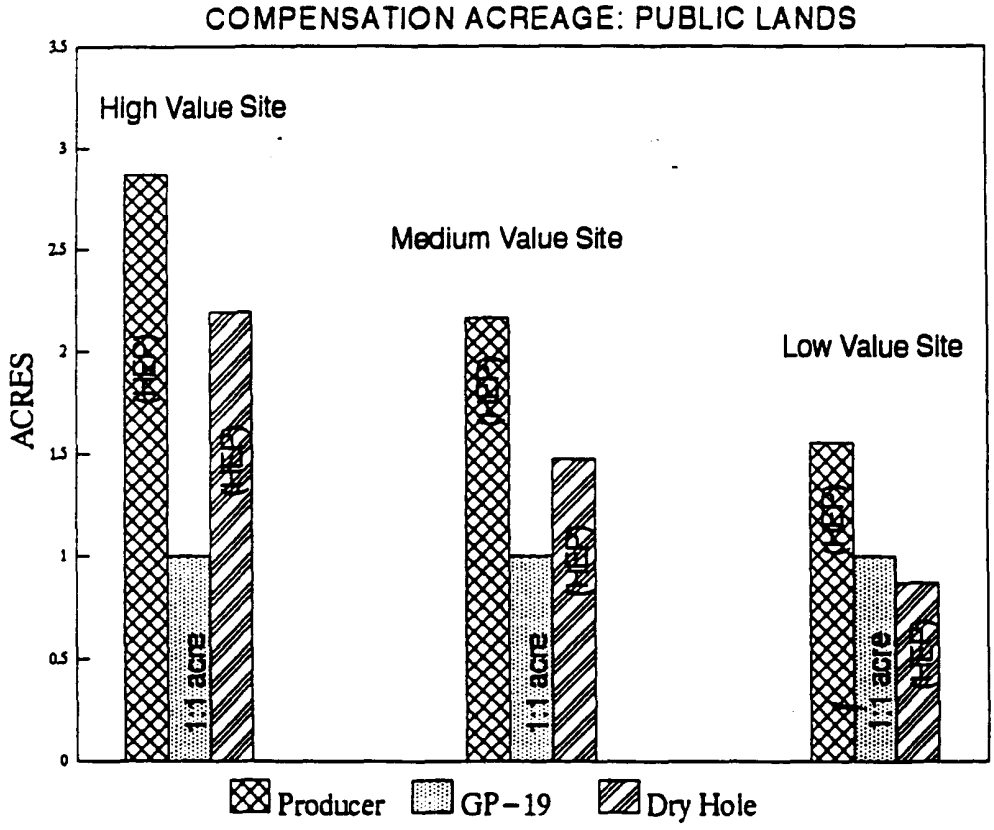
Sheets 1 and 2 compare HEP-based and proposed GP-19 compensatory mitigation acreage requirements when compensation work is done on public versus private lands. As indicated on Sheet 1, a shortfall of up to 65 percent would occur when high-value forested wetlands are affected and compensation would occur on public wildlife lands. The Service's habitat assessment methodology also concludes that the District's acre-for-acre compensatory mitigation proposal will result in over-compensation in those extreme cases where impacts to lower quality wetland habitats are compensated on privately-owned and cleared wetland sites that would not increase in value over time (Sheet 2). However, this situation is expected to occur rarely, since the added expense of compensating on privately-owned land makes this option economically undesirable.

Sheets 3 through 17 detail the assessment of impacts for the two development scenarios (production and non-production), followed by potential compensation generated on public and private lands, as well as a summary table. The analysis has been performed for a typical high (Sheets 3 - 7), medium (Sheets 8 - 12), and low (Sheets 13 - 17) value one-acre site.

GP – 19 HEP COMPENSATORY MITIGATION SUMMARY

Compensatory Mitigation Acreage Requirements: Public Lands

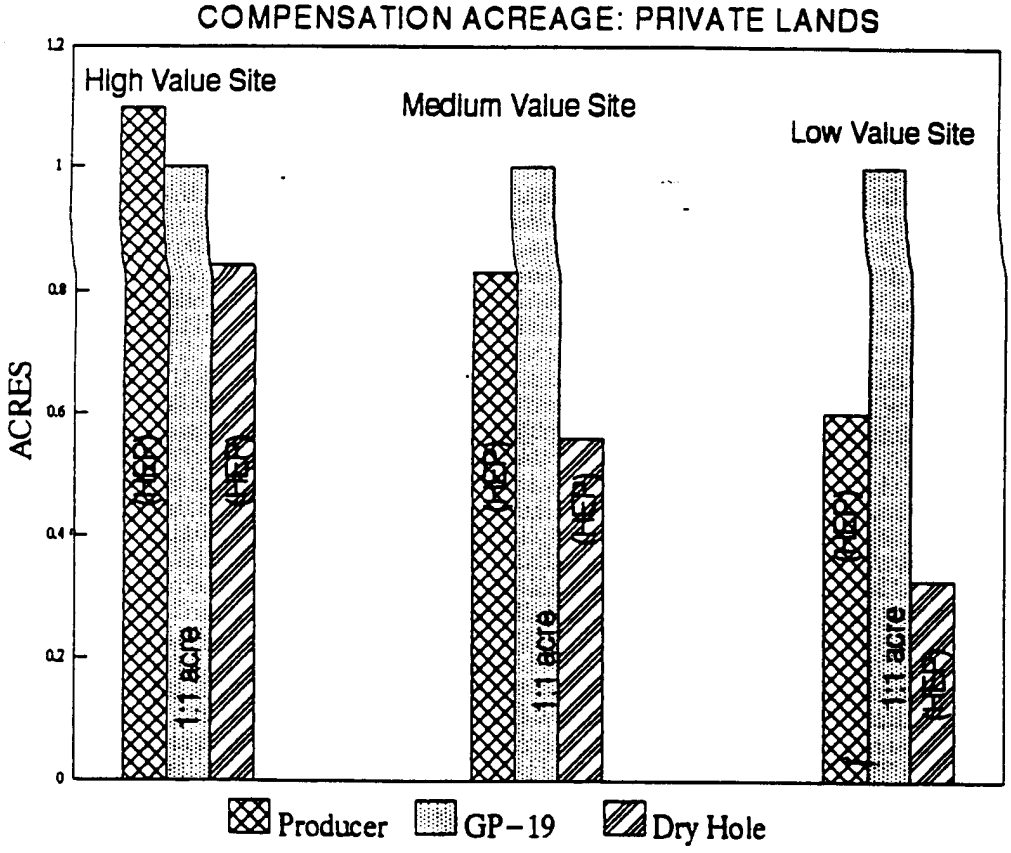
IMPACT AREA	PRODUCING WELL		DRY HOLE	
AREA VALUE	HEP – BASED COMP. ACRES	CE PERCENT DIFFERENCE	HEP – BASED COMP. ACRES	CE PERCENT DIFFERENCE
HIGH	2.87	– 65.2	2.19	– 54.3
MEDIUM	2.16	– 53.7	1.47	– 32.0
LOW	1.55	– 35.5	0.87	14.9



GP – 19 HEP COMPENSATORY MITIGATION SUMMARY

Compensatory Mitigation Acreage Requirements: Private Lands

IMPACT AREA	PRODUCING WELL		DRY HOLE	
AREA VALUE	HEP – BASED COMP. ACRES	CE PERCENT DIFFERENCE	HEP – BASED COMP. ACRES	CE PERCENT DIFFERENCE
HIGH	1.10	–9.1	0.84	19.0
MEDIUM	0.83	20.5	0.56	78.6
LOW	0.60	66.7	0.33	203.0



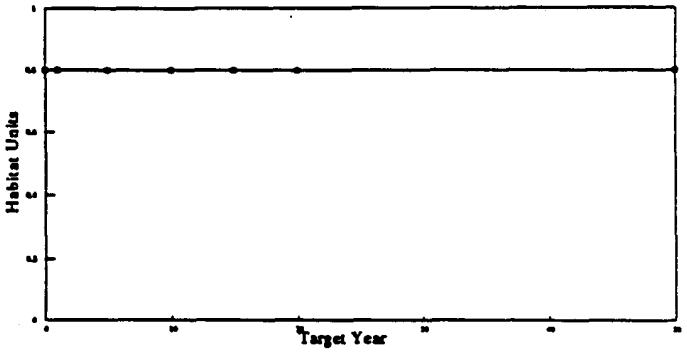
EXAMPLE HEP FOR GP–19: HIGH VALUE SITE

PROJECT SCENARIO: Producing well (assume 15–year production)

Project area size: 1 acre
Project economic life: 50 years

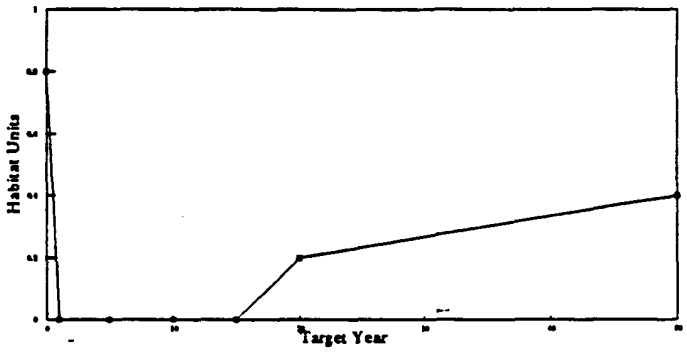
FUTURE WITHOUT PROJECT

TY	ACRES	HSI	TOTAL HU'S	CUMMUL HU'S
0	1	0.80	0.80	
1	1	0.80	0.80	0.80
5	1	0.80	0.80	3.20
10	1	0.80	0.80	4.00
15	1	0.80	0.80	4.00
20	1	0.80	0.80	4.00
50	1	0.80	0.80	24.00
			AAHU'S =	0.80

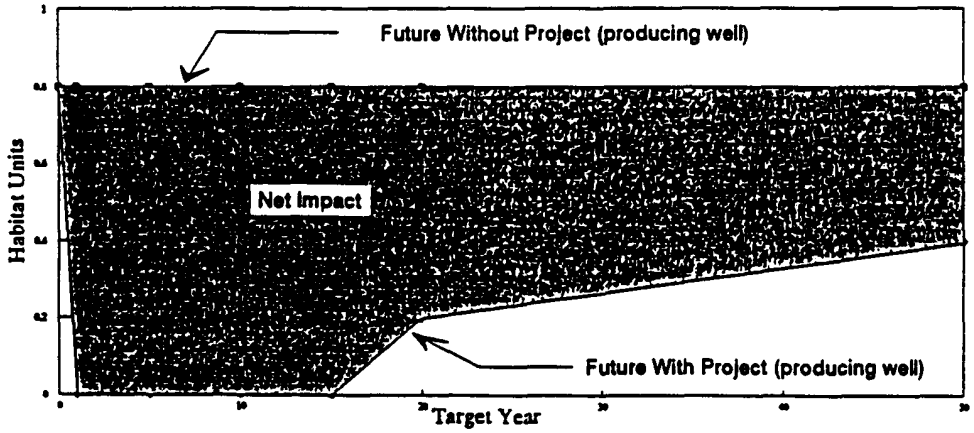


FUTURE WITH PROJECT
(assume complete habitat loss for 15–year production period)

TY	ACRES	HSI	TOTAL HU'S	CUMMUL HU'S
0	1	0.80	0.80	
1	1	0.00	0.00	0.40
5	1	0.00	0.00	0.00
10	1	0.00	0.00	0.00
15	1	0.00	0.00	0.00
20	1	0.20	0.20	0.50
50	1	0.40	0.40	9.00
			AAHU'S =	0.20



AAHU'S WITHOUT PROJECT	0.80
AAHU'S WITH PROJECT (PRODUCER)	0.20
NET AAHU CHANGE DUE TO PRODUCER (impact)	–0.60

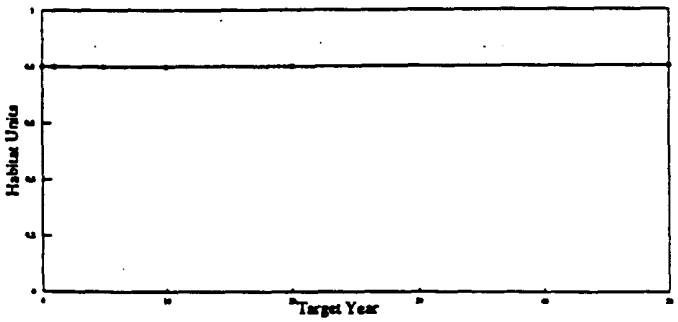


PROJECT SCENARIO: Dry hole

Project area size: 1 acre
Project economic life: 50 years

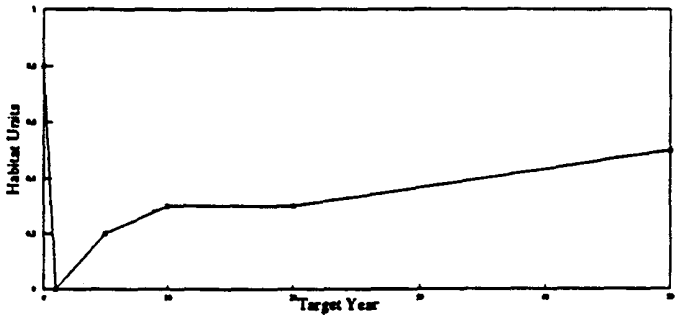
FUTURE WITHOUT PROJECT

TY	ACRES	HSI	TOTAL HU'S	CUMMUL HU'S
0	1	0.80	0.80	
1	1	0.80	0.80	0.80
5	1	0.80	0.80	3.20
10	1	0.80	0.80	4.00
20	1	0.80	0.80	8.00
50	1	0.80	0.80	24.00
			AAHU'S =	0.80



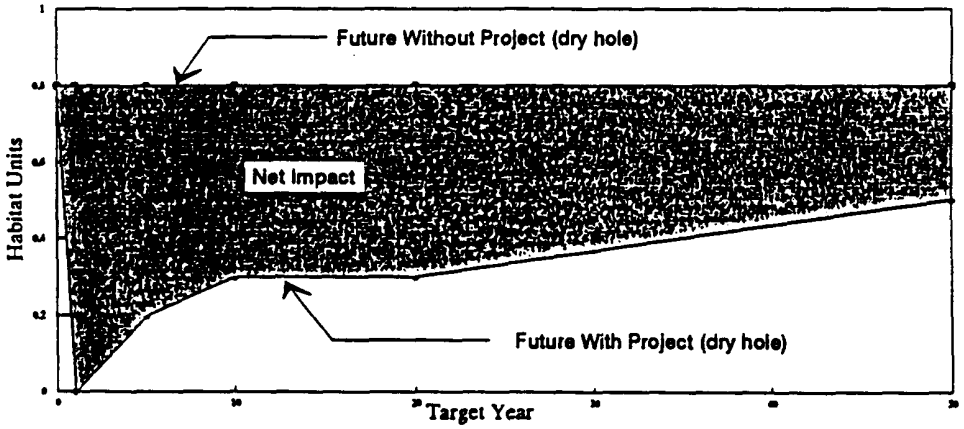
FUTURE WITH PROJECT

TY	ACRES	HSI	TOTAL HU'S	CUMMUL HU'S
0	1	0.80	0.80	
1	1	0.00	0.00	0.40
5	1	0.20	0.20	0.40
10	1	0.30	0.30	1.25
20	1	0.30	0.30	3.00
50	1	0.50	0.50	12.00
			AAHU'S =	0.34



AAHU'S WITHOUT PROJECT 0.80
AAHU'S WITH PROJECT (DRY HOLE) 0.34

NET AAHU CHANGE DUE TO DRY HOLE (impact) −0.46

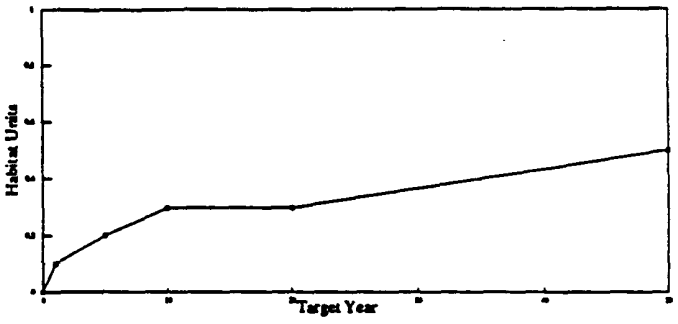


MITIGATION SCENARIO #1: Public lands-- seedlings

P/ area size: 1 acre
P. ife: 50 years

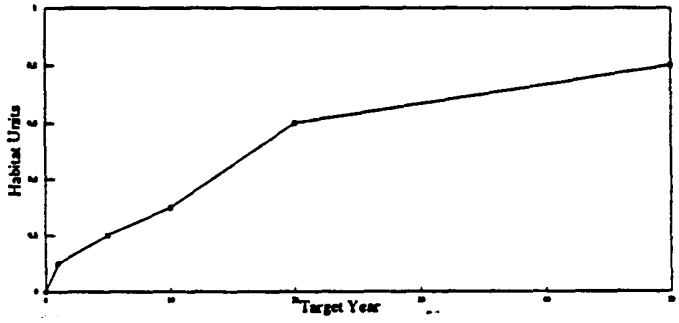
FUTURE WITHOUT PLANTING (natural succession)

TY	ACRES	HSI	TOTAL HU'S	CUMMUL HU'S
0	1	0.00	0.00	
1	1	0.10	0.10	0.05
5	1	0.20	0.20	0.60
10	1	0.30	0.30	1.25
20	1	0.30	0.30	3.00
50	1	0.50	0.50	12.00
			AAHU'S =	0.34



FUTURE WITH PLANTING

TY	ACRES	HSI	TOTAL HU'S	CUMMUL HU'S
0	1	0.00	0.00	
1	1	0.10	0.10	0.05
5	1	0.20	0.20	0.60
10	1	0.30	0.30	1.25
20	1	0.60	0.60	4.50
50	1	0.80	0.80	21.00
			AAHU'S =	0.55



AAHU'S WITHOUT MANAGEMENT 0.34
AAHU'S WITH MANAGEMENT 0.55

NET AAHU CHANGE DUE MANAGEMENT 0.21
(management potential)

COMPENSATORY MITIGATION SUMMARY: Mitigation Scenario #1

(Impact / Management Potential) = Impact to Management Ratio

The Impact to Management Ratio is the ratio of how impact (i.e., project) HU losses are offset by management (i.e., mitigation) HU gains, given specified project and mitigation scenarios.

Project losses (producer well) -0.60 AAHU's
Project losses (dry hole) -0.46 AAHU'S
Mitigation gains 0.21 AAHU's

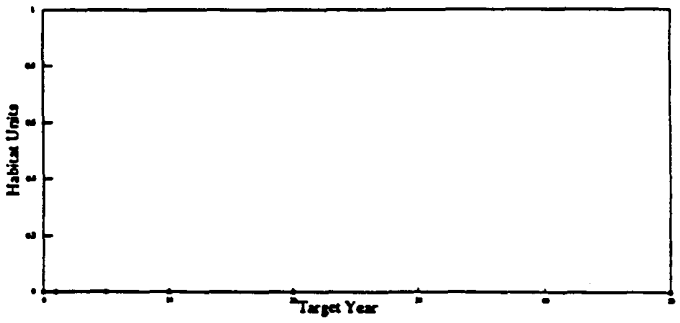
	Producer	Dry Hole
Compensatory Mitigation Acreage Required =	2.87 acres	2.19 acres

MITIGATION SCENARIO #2: Private land-- seedlings

Project area size: 1 acre
P life: 50 years

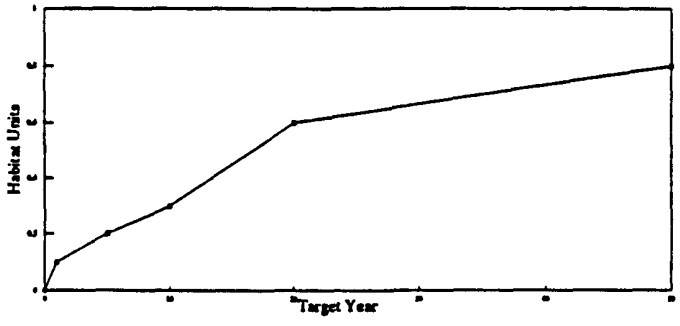
FUTURE WITHOUT MITIGATION (agricultural field)

TY	ACRES	HSI	TOTAL HU'S	CUMMUL. HU'S
0	1	0.00	0.00	
1	1	0.00	0.00	0.00
5	1	0.00	0.00	0.00
10	1	0.00	0.00	0.00
20	1	0.00	0.00	0.00
50	1	0.00	0.00	0.00
			AAHU'S =	0.00



FUTURE WITH MITIGATION (plant seedlings)

TY	ACRES	HSI	TOTAL HU'S	CUMMUL. HU'S
0	1	0.00	0.00	
1	1	0.10	0.10	0.05
5	1	0.20	0.20	0.60
10	1	0.30	0.30	1.25
20	1	0.60	0.60	4.50
50	1	0.80	0.80	21.00
			AAHU'S =	0.55



AAHU'S WITHOUT MANAGEMENT 0.00
AAHU'S WITH MANAGEMENT 0.55

NET AAHU CHANGE DUE MANAGEMENT 0.55
(management potential)

COMPENSATORY MITIGATION SUMMARY: Mitigation Scenario #2

(Impact / Management Potential) = Impact to Management Ratio

The Impact to Management Ratio is the ratio of how impact (i.e., project) HU losses are offset by management (i.e., mitigation) HU gains, given specified project and mitigation scenarios.

Project losses (producer well) -0.60 AAHU's
Project losses (dry hole) -0.46 AAHU'S
Mitigation gains 0.55 AAHU's

	Producer	Dry Hole
Compensatory Mitigation Acreage Required =	1.10 acres	0.84 acres

Summary of Mitigation Requirements (acres) for GP19 Project and Mitigation Scenarios

High Value Site

Mitigation Scenario	Project Scenario	
	Producer Well	Dry Hole
#1 FWOM– Ag field reverting via natural succession FWM– Ag field planted with seedlings	2.87	2.19
#2 FWOM– Ag field staying in production FWM– Ag field planted with seedlings	1.10	0.84

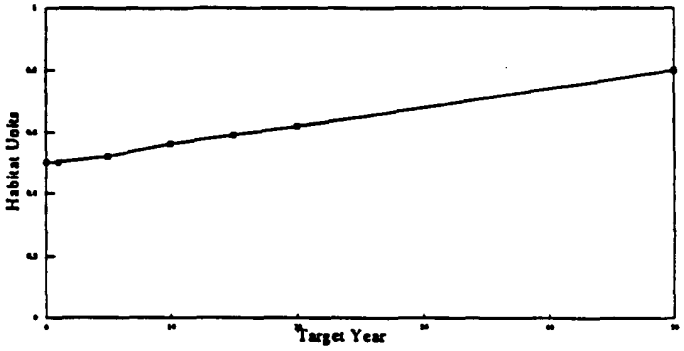
EXAMPLE HEP FOR GP–19: MEDIUM VALUE SITE

PROJECT SCENARIO: Producing well (assume 15–year production)

Project area size: 1 acre
Pr ɔconomic life: 50 years

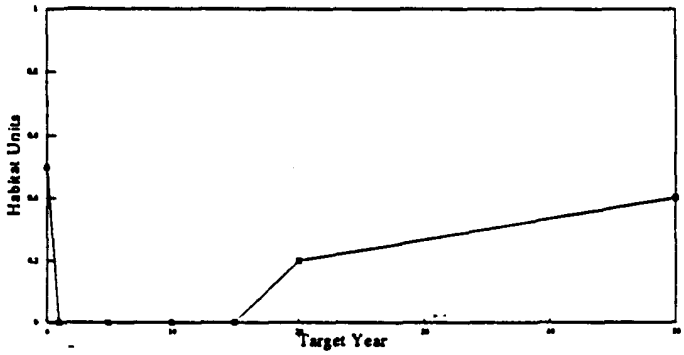
FUTURE WITHOUT PROJECT

TY	ACRES	HSI	TOTAL HU'S	CUMMUL. HU'S
0	1	0.50	0.50	
1	1	0.50	0.50	0.50
5	1	0.52	0.52	2.04
10	1	0.56	0.56	2.70
15	1	0.59	0.59	2.88
20	1	0.62	0.62	3.03
50	1	0.80	0.80	21.30
			AAHU'S =	0.65



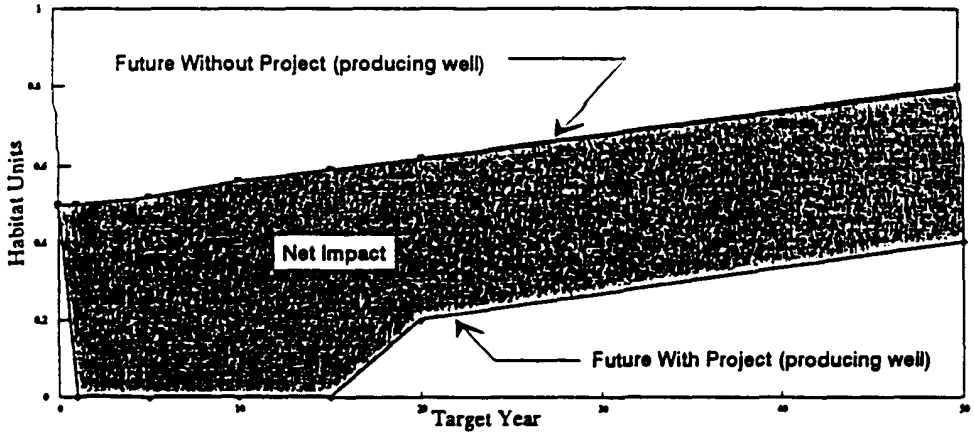
FUTURE WITH PROJECT
(assume complete habitat loss for 15–year production period)

TY	ACRES	HSI	TOTAL HU'S	CUMMUL. HU'S
0	1	0.50	0.50	
1	1	0.00	0.00	0.25
5	1	0.00	0.00	0.00
10	1	0.00	0.00	0.00
15	1	0.00	0.00	0.00
20	1	0.20	0.20	0.50
50	1	0.40	0.40	9.00
			AAHU'S =	0.20



AAHU'S WITHOUT PROJECT 0.65
AAHU'S WITH PROJECT (PRODUCER) 0.20

NET AAHU CHANGE DUE TO PRODUCER –0.45
(impact)

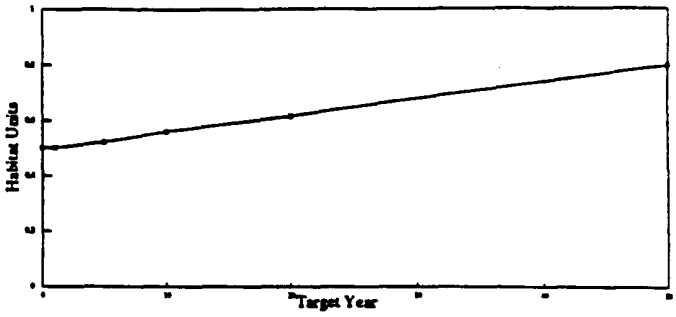


PROJECT SCENARIO: Dry hole

Project area size: 1 acre
Project economic life: 50 years

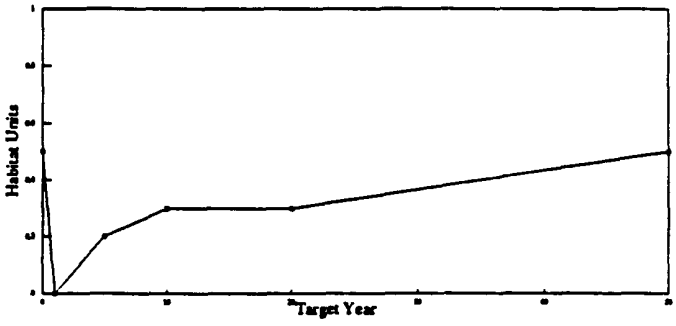
FUTURE WITHOUT PROJECT

TY	ACRES	HSI	TOTAL HU'S	CUMMUL. HU'S
0	1	0.50	0.50	
1	1	0.50	0.50	0.50
5	1	0.52	0.52	2.04
10	1	0.56	0.56	2.70
20	1	0.62	0.62	5.90
50	1	0.80	0.80	21.30
			AAHU'S =	0.65



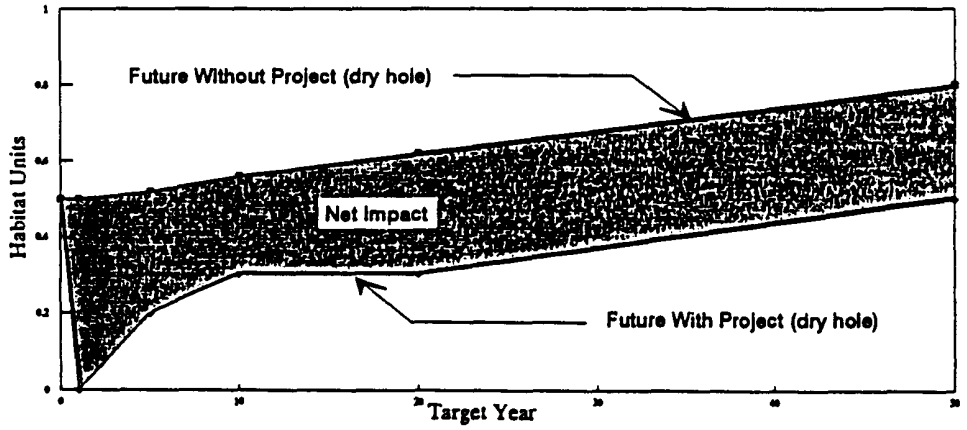
FUTURE WITH PROJECT

TY	ACRES	HSI	TOTAL HU'S	CUMMUL. HU'S
0	1	0.50	0.50	
1	1	0.00	0.00	0.25
5	1	0.20	0.20	0.40
10	1	0.30	0.30	1.25
20	1	0.30	0.30	3.00
50	1	0.50	0.50	12.00
			AAHU'S =	0.34



AAHU'S WITHOUT PROJECT 0.65
AAHU'S WITH PROJECT (DRY HOLE) 0.34

NET AAHU CHANGE DUE TO DRY HOLE (impact) −0.31



MITIGATION SCENARIO #1: Public lands-- seedlings

Project area size: 1 acre
Project life: 50 years

FUTURE WITHOUT PLANTING (natural succession)

TY	ACRES	HSI	TOTAL HU'S	CUMMUL. HU'S
0	1	0.00	0.00	
1	1	0.10	0.10	0.05
5	1	0.20	0.20	0.60
10	1	0.30	0.30	1.25
20	1	0.30	0.30	3.00
50	1	0.50	0.50	12.00
			AAHU'S =	0.34

FUTURE WITH PLANTING

TY	ACRES	HSI	TOTAL HU'S	CUMMUL. HU'S
0	1	0.00	0.00	
1	1	0.10	0.10	0.05
5	1	0.20	0.20	0.60
10	1	0.30	0.30	1.25
20	1	0.60	0.60	4.50
50	1	0.80	0.80	21.00
			AAHU'S =	0.55

AAHU'S WITHOUT MANAGEMENT 0.34
AAHU'S WITH MANAGEMENT 0.55

NET AAHU CHANGE DUE MANAGEMENT 0.21
(management potential)

COMPENSATORY MITIGATION SUMMARY: Mitigation Scenario #1

(Impact / Management Potential) = Impact to Management Ratio

The Impact to Management Ratio is the ratio of how impact (i.e., project) HU losses are offset by management (i.e., mitigation) HU gains, given specified project and mitigation scenarios.

Project losses (producer well) -0.45 AAHU's Project losses (dry hole) -0.31 AAHU'S
Mitigation gains 0.21 AAHU's

	Producer	Dry Hole
Compensatory Mitigation Acreage Required =	2.16 acres	1.48 acres

MITIGATION SCENARIO #2: Private land-- seedlings

Project area size: 1 acre
P * life: 50 years

FUTURE WITHOUT MITIGATION (agricultural field)

TY	ACRES	HSI	TOTAL HU'S	CUMMUL. HU'S
0	1	0.00	0.00	
1	1	0.00	0.00	0.00
5	1	0.00	0.00	0.00
10	1	0.00	0.00	0.00
20	1	0.00	0.00	0.00
50	1	0.00	0.00	0.00
			AAHU'S =	0.00

FUTURE WITH MITIGATION (plant seedlings)

TY	ACRES	HSI	TOTAL HU'S	CUMMUL. HU'S
0	1	0.00	0.00	
1	1	0.10	0.10	0.05
5	1	0.20	0.20	0.60
10	1	0.30	0.30	1.25
20	1	0.60	0.60	4.50
50	1	0.80	0.80	21.00
			AAHU'S =	0.55

AAHU'S WITHOUT MANAGEMENT 0.00
AAHU'S WITH MANAGEMENT 0.55

NET AAHU CHANGE DUE MANAGEMENT 0.55
(management potential)

COMPENSATORY MITIGATION SUMMARY: Mitigation Scenario #2

(Impact / Management Potential) = Impact to Management Ratio

The Impact to Management Ratio is the ratio of how impact (i.e., project) HU losses are offset by management (i.e., mitigation) HU gains, given specified project and mitigation scenarios.

Project losses (producer well) -0.45 AAHU's Project losses (dry hole) -0.31 AAHU'S
Mitigation gains 0.55 AAHU's

	Producer	Dry Hole
Compensatory Mitigation Acreage Required =	0.83 acres	0.57 acres

Summary of Mitigation Requirements (acres) for GP19 Project and Mitigation Scenarios

Medium Value Site

Mitigation Scenario	Project Scenario	
	Producer Well	Dry Hole
#1 FWOM– Ag field reverting via natural succession FWM– Ag field planted with seedlings	2.16	1.48
#2 FWOM– Ag field staying in production FWM– Ag field planted with seedlings	0.83	0.57

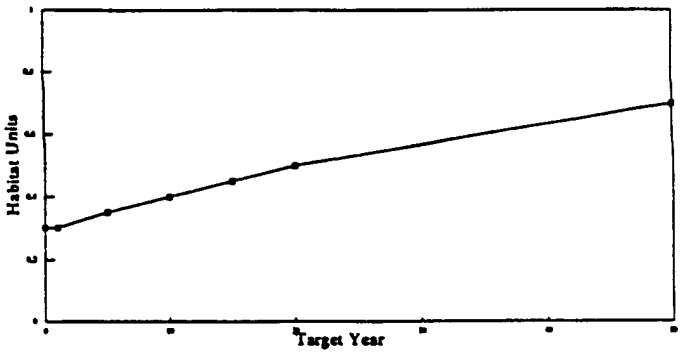
EXAMPLE HEP FOR GP–19: LOW VALUE SITE

PROJECT SCENARIO: Producing well (assume 15–year production)

Project area size: 1 acre
Pr[illegible]life: 50 years

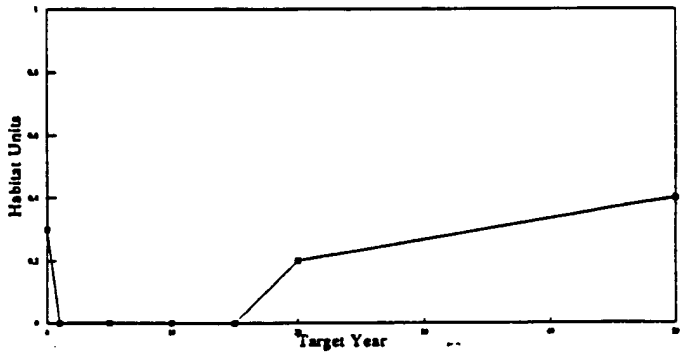
FU[illegible]E WITHOUT PROJECT

TY	ACRES	HSI	TOTAL HU'S	CUMMUL. HU'S
0	1	0.30	0.30	
1	1	0.30	0.30	0.30
5	1	0.35	0.35	1.30
10	1	0.40	0.40	1.88
15	1	0.45	0.45	2.13
20	1	0.50	0.50	2.38
50	1	0.70	0.70	18.00
			AAHU'S =	0.52



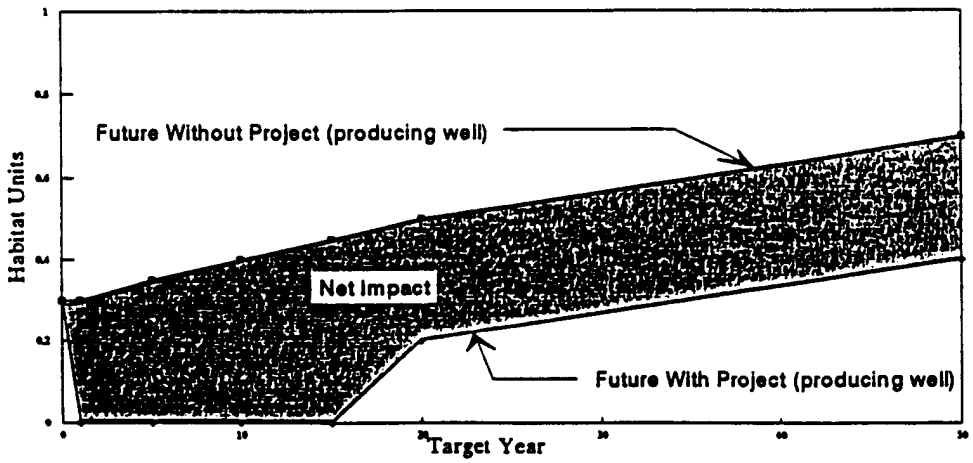
FUTURE WITH PROJECT
(assume complete habitat loss for 15–year production period)

TY	ACRES	HSI	TOTAL HU'S	CUMMUL. HU'S
0	1	0.30	0.30	
1	1	0.00	0.00	0.15
5	1	0.00	0.00	0.00
10	1	0.00	0.00	0.00
15	1	0.00	0.00	0.00
20	1	0.20	0.20	0.50
50	1	0.40	0.40	9.00
			AAHU'S =	0.19



AAHU'S WITHOUT PROJECT 0.52
AAHU'S WITH PROJECT (PRODUCER) 0.19

NET AAHU CHANGE DUE TO PRODUCER –0.33
(impact)

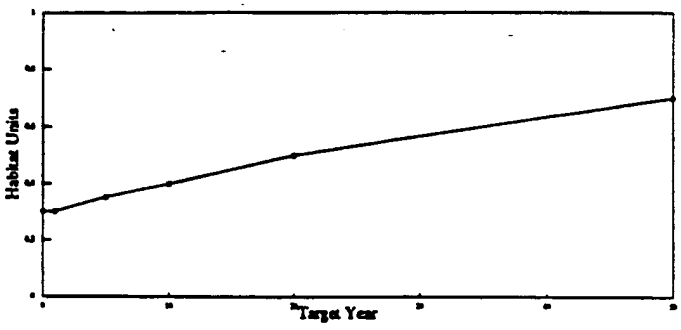


PROJECT SCENARIO: Dry hole

Project area size: 1 acre
Project life: 50 years

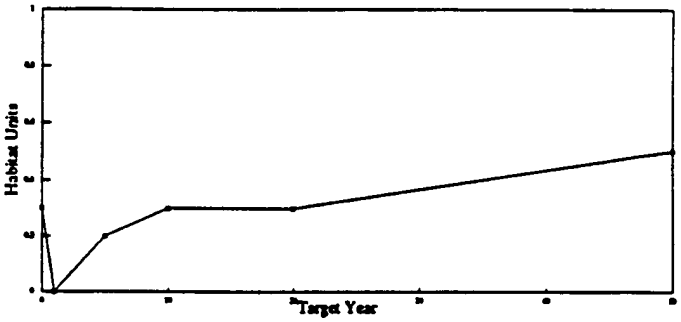
F : WITHOUT PROJECT

TY	ACRES	HSI	TOTAL HU'S	CUMMUL. HU'S
0	1	0.30	0.30	
1	1	0.30	0.30	0.30
5	1	0.35	0.35	1.30
10	1	0.40	0.40	1.88
20	1	0.50	0.50	4.50
50	1	0.70	0.70	18.00
		AAHU'S		0.52



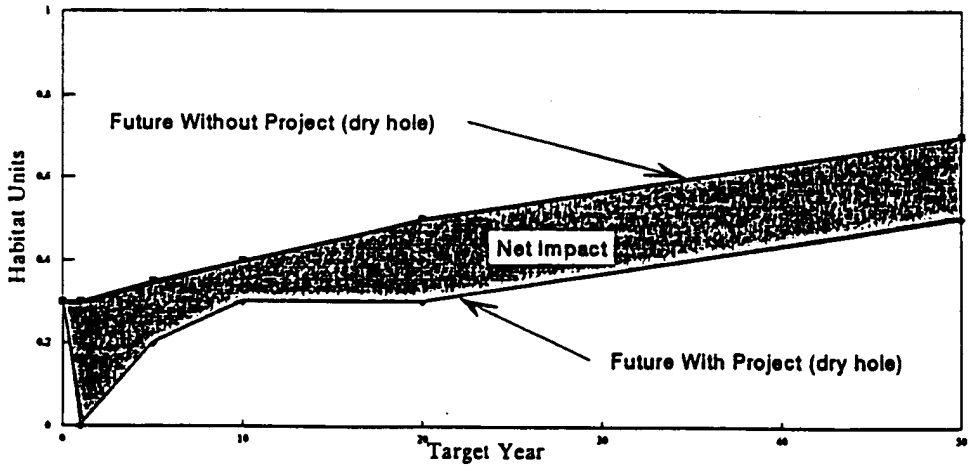
FUTURE WITH PROJECT

TY	ACRES	HSI	TOTAL HU'S	CUMMUL. HU'S
0	1	0.30	0.30	
1	1	0.00	0.00	0.15
5	1	0.20	0.20	0.40
10	1	0.30	0.30	1.25
20	1	0.30	0.30	3.00
50	1	0.50	0.50	12.00
		AAHU'S		0.34



AAHU'S WITHOUT PROJECT 0.52
AAHU'S WITH PROJECT (DRY HOLE) 0.34

NET AAHU CHANGE DUE TO DRY HOLE (impact) −0.18



MITIGATION SCENARIO #1: Public lands-- seedlings

Project area size: 1 acre
F t life: 50 years

FUTURE WITHOUT PLANTING (natural succession)

TY	ACRES	HSI	TOTAL HU'S	CUMMUL. HU'S
0	1	0.00	0.00	
1	1	0.10	0.10	0.05
5	1	0.20	0.20	0.60
10	1	0.30	0.30	1.25
20	1	0.30	0.30	3.00
50	1	0.50	0.50	12.00
		AAHU'S		0.34

FUTURE WITH PLANTING

TY	ACRES	HSI	TOTAL HU'S	CUMMUL. HU'S
0	1	0.00	0.00	
1	1	0.10	0.10	0.05
5	1	0.20	0.20	0.60
10	1	0.30	0.30	1.25
20	1	0.60	0.60	4.50
50	1	0.80	0.80	21.00
		AAHU'S		0.55

AAHU'S WITHOUT MANAGEMENT 0.34
AAHU'S WITH MANAGEMENT 0.55

NET AAHU CHANGE DUE MANAGEMENT 0.21
(management potential)

COMPENSATORY MITIGATION SUMMARY: Mitigation Scenario #1

(Impact / Management Potential) = Impact to Management Ratio

The Impact to Management Ratio is the ratio of how impact (i.e., project) HU losses are offset by management (i.e., mitigation) HU gains, given specified project and mitigation scenarios.

Project losses (producer well) -0.33 AAHU's
Mitigation gains 0.21 AAHU's

Project losses (dry hole) -0.18 AAHU'S

	Producer	Dry Hole
Compensatory Mitigation Acreage Required =	1.55 acres	0.87 acres

MITIGATION SCENARIO #2: Private land-- seedlings

Project area size: 1 acre
F [illegible] life: 50 years

FUTURE WITHOUT MITIGATION (agricultural field)

TY	ACRES	HSI	TOTAL HU'S	CUMMUL. HU'S
0	1	0.00	0.00	
1	1	0.00	0.00	0.00
5	1	0.00	0.00	0.00
10	1	0.00	0.00	0.00
20	1	0.00	0.00	0.00
50	1	0.00	0.00	0.00
		AAHU'S		0.00

FUTURE WITH MITIGATION (plant seedlings)

TY	ACRES	HSI	TOTAL HU'S	CUMMUL. HU'S
0	1	0.00	0.00	
1	1	0.10	0.10	0.05
5	1	0.20	0.20	0.60
10	1	0.30	0.30	1.25
20	1	0.60	0.60	4.50
50	1	0.80	0.80	21.00
		AAHU'S		0.55

AAHU'S WITHOUT MANAGEMENT 0.00
AAHU'S WITH MANAGEMENT 0.55

NET AAHU CHANGE DUE MANAGEMENT 0.55
(management potential)

COMPENSATORY MITIGATION SUMMARY: Mitigation Scenario #2

(Impact / Management Potential) = Impact to Management Ratio

The Impact to Management Ratio is the ratio of how impact (i.e., project) HU losses are offset by management (i.e., mitigation) HU gains, given specified project and mitigation scenarios.

Project losses (producer well) -0.33 AAHU's
Project losses (dry hole) -0.18 AAHU'S
Mitigation gains 0.55 AAHU's

	Producer	Dry Hole
Compensatory Mitigation Acreage Required =	0.60 acres	0.33 acres

Summary of Mitigation Requirements (acres) for GP19 Project and Mitigation Scenarios

Low Value Site

...tion Scenario	Project Scenario	
	Producer Well	Dry Hole
#1 FWOM– Ag field reverting via natural succession FWM– Ag field planted with seedlings	1.55	0.87
#2 FWOM– Ag field staying in production FWM– Ag field planted with seedlings	0.60	0.33