THE VALORIZATION OF FEDERAL PORE SPACE

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ABSTRACT

Carbon sequestration is essential to achieving the United States' climate change mitigation and net-zero objectives. Congress has invested billions of dollars in tax credits, demonstration projects, technology research and development, and state-level regulatory capacity-building to encourage carbon sequestration. These policies have resulted in proposals to use millions of acres of subsurface pore space for climate mitigation through geologic carbon storage.

The federal government is the single largest owner of pore space in the United States, controlling millions of acres of pore space in both onshore and submerged lands. These resources underlie national forests, wildlife preserves, parks and monuments, and defense lands. Undeniably, some of these lands will be necessary for commercial-scale geologic carbon sequestration—in fact, the government's ownership of contiguous, basin-scale pore space resources may make it uniquely valuable and essential to achieving carbon removal goals. Federal land management agencies have made initial progress identifying pathways for pore space acquisition within existing land management statutes, yet one question endures: How should rights in federal pore space be priced?

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This Article is the first to provide a comprehensive look at the federal subsurface. Taking an inclusive and interagency approach, it delves into a labyrinth of federal agency manuals, guidance, and precedents transecting federal agencies and the fossil and renewable sectors. These examples illuminate commonalities among principles and methodologies that can be applied to the conceptually unique challenge of valuing property grants for sequestration. This Article develops and evaluates these alternatives and explores the implications of valuation choices for land management and climate policy.

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INTRODUCTION

After decades of research into the feasibility of capturing and geologically storing anthropogenic carbon dioxide ("CO_2") emissions, carbon capture and storage ("CCS") is on the verge of wide-scale deployment across the United States. CCS is expected to serve a critical function in the decarbonization of the United States' electrical, fuel, and hard-to-abate industrial sectors.[1] It refers to a subset of deep decarbonization techniques that result in the reduction of CO_2 emissions by capturing them and permanently storing them in geologic formations thousands of feet underground.[2] Once injected, the CO_2 compresses into a near liquid and spreads throughout the formation in a plume.[3] For commercial-size projects, the subsurface footprint of these plumes and the associated areas of pressure and fluid migration can span thousands, or even hundreds of thousands, of acres.[4]

[1] INT'L ENERGY AGENCY, ENERGY TECHNOLOGY PERSPECTIVES 2020, at 104-08 (2020), https://www.iea.org/reports/energy-technology-perspectives-2020 [https://perma.cc/V8C2-4CAV]; Almut Arneth et al., *Summary for Policy Makers*, *in* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE AND LAND: AN IPCC SPECIAL REPORT ON CLIMATE CHANGE, DESERTIFICATION, LAND DEGRADATION, SUSTAINABLE LAND MANAGEMENT, FOOD SECURITY, AND GREENHOUSE GAS FLUXES IN TERRESTRIAL ECOSYSTEMS 3, 23-25 (Priyadarshi R. Shukla et al. eds., 2022); U.S. DEP'T OF STATE & EXEC. OFF. OF THE PRESIDENT, THE LONG-TERM STRATEGY OF THE UNITED STATES: PATHWAYS TO NET-ZERO GREENHOUSE GAS EMISSIONS BY 2050, at 48-49 (2021), https://unfccc.int/sites/default/files/resource/US_accessibleLTS2021.pdf [https://perma.cc/KM4E-GT3F]. For a discussion of how CCS provides one of the only technologies that can address process emissions from hard-to-abate sectors such as the cement, chemical, and steel manufacturing industries in addition to those from power generation, see Stéphanie Bouckaert et al., INT'L ENERGY AGENCY, NET-ZERO BY 2050: A ROADMAP FOR THE GLOBAL ENERGY SECTOR 95-98 (Edmund Hosker ed., 4th rev. 2021), https://www.iea.org/reports/net-zero-by-2050 [https://perma.cc/88TL-ALX6].

[2] *Carbon Storage FAQs*, NAT'L ENERGY TECH. LAB'Y, https://netl.doe.gov/carbon-management/carbon-storage/faqs/carbon-storage-faqs [https://perma.cc/8HFQ-4A9Q] (last visited Mar. 19, 2025) ("Carbon capture and storage (CCS) is the separation and capture of carbon dioxide (CO_2) from the emissions of industrial processes prior to release into the atmosphere and storage of the CO_2 in deep underground geologic formations."). Suitable formations can include oil and gas reservoirs, saline aquifers, unmineable coal seams, or sedimentary basins. NAT'L ENERGY TECH. LAB'Y & DEP'T OF ENERGY, CARBON STORAGE ATLAS 6 (5th ed. 2015), https://netl.doe.gov/sites/default/files/2018-10/ATLAS-V-2015.pdf [https://perma.cc/AT9C-LHN4].

[3] *Carbon Storage FAQs*, *supra* note 2; NAT'L ENERGY TECH. LAB'Y & DEP'T OF ENERGY, CARBON STORAGE ATLAS, *supra* note 2, at 6.

[4] *See* 40 C.F.R. § 146.84 (2024); EPA, No. 816-R-13-005, GEOLOGIC SEQUESTRATION OF CARBON DIOXIDE: UNDERGROUND INJECTION CONTROL (UIC) PROGRAM CLASS VI WELL AREA OF REVIEW EVALUATION AND CORRECTIVE ACTION GUIDANCE 2 (2013) ("Therefore, the [area of review] encompasses the region overlying the separate-phase (e.g., supercritical, liquid, or gaseous) carbon dioxide plume and the region overlying the pressure front where fluid pressures are sufficient to force fluids into [an underground source of drinking water].").

Congress has enacted both regulations and incentives related to CCS. Injection activities and subsurface plumes are regulated by the Environmental Protection Agency ("EPA"), relying on its delegated authority pursuant to the Safe Drinking Water Act ("SDWA").[5] CO_2 injection wells fall into one of two Underground Injection Control ("UIC") Program categories: "Class II" wells used for oil and gas operations and "Class VI" wells that inject anthropogenic CO_2 for geologic storage.[6] To encourage CCS, Congress created the § 45Q tax incentive, which awards a credit for each ton of CO_2 that is captured and safely secured underground.[7] Initially passed in 2008,[8] the credit was significantly modified and expanded in 2022 by the Inflation Reduction Act ("IRA").[9] Among other benefits, the IRA increased the credit up to $180 per ton of CO_2 sequestered via direct air capture ("DAC") and up to $85 per ton of CO_2 captured and stored from point-source facilities.[10]

These changes, along with new funding allocated toward research and development across the country, have galvanized interest in CCS.[11] In the United States, there are 15 CCS facilities currently in operation and an additional 121

[5] 42 U.S.C. § 300h(a). The SDWA requires the EPA to set standards "to assure that underground sources of drinking water will not be endangered by any underground injection." *Id.* § 300h(b)(3)(C). States with their own Class VI frameworks can apply to the EPA for primary enforcement authority ("primacy") if the state's program meets minimum federal requirements. *Id.* § 300h-1; 40 C.F.R. § 147 (2024). To date, only three states—North Dakota, Wyoming, and Louisiana—have obtained primacy for all well classes. *Primary Enforcement Authority for the Underground Injection Control Program*, EPA, https://www.epa.gov/uic/primary-enforcement-authority-underground-injection-control-program-0 [https://perma.cc/24X9-JCV4] (last updated Jan. 24, 2025).

[6] 40 C.F.R. § 144.6(b), (f).

[7] Energy Improvement and Extension Act of 2008, Pub. L. No. 110-343, § 115(a), 122 Stat. 3807, 3829-31 (2008) (codified as amended at I.R.C. § 45Q) (instituting credit for "$20 per metric ton of qualified carbon dioxide" sequestered by taxpayer).

[8] *Id.*

[9] *See* Inflation Reduction Act, Pub. L. No. 117-169, § 13104, 136 Stat. 1818, 1924-29 (2022) (codified at I.R.C. § 45Q).

> In addition to modifying the base credit rates and definition of qualified facilities, the IRA allowed a larger credit for qualified facilities or carbon capture equipment that meet certain prevailing wage and apprenticeship requirements. In addition, the IRA extended eligibility to claim the credit to certain nonprofits ("direct pay") and entities without ownership interests ("transferability") and extended the deadline to begin construction to the end of 2032.

ANGELA C. JONES & DONALD J. MARPLES, CONG. RSCH. SERV., IF11455, THE SECTION 45Q TAX CREDIT FOR CARBON SEQUESTRATION 1 (version 4, 2023), https://crsreports.congress.gov/product/pdf/IF/IF11455 [https://perma.cc/26JU-WK9E].

[10] Inflation Reduction Act § 13104; JONES & MARPLES, *supra* note 9, at 2.

[11] CONG. BUDGET OFF., CARBON CAPTURE AND STORAGE IN THE UNITED STATES 3, 9 (2023), https://www.cbo.gov/system/files/2023-12/59345-carbon-capture-storage.pdf [https://perma.cc/4PMD-XXQV].

under development and construction.[12] These facilities have the projected capacity to eventually capture up to 156 million metric tons of CO_2 per year—or 3% of the nation's CO_2 emissions.[13] Yet even if all are developed, these projects barely scratch the surface in terms of potential CO_2 removal. For instance, a 2013 assessment by the United States Geological Survey ("USGS"), Department of Interior ("DOI"), and other state and federal agency partners estimated that as much as 470,000 megatons of technically suitable storage capacity exists in the United States—enough for 3,000 metric gigatons of CO_2.[14] In the western United States, these storage basins underlie sizeable portions of Washington, Oregon, Utah, Wyoming, Montana, and Nevada, as well as smaller parts of Colorado, New Mexico, and California.[15] Many of the potential storage basins are underneath public lands.[16]

Use of federally owned pore space will be critical to widespread deployment and utilization of geologic storage in the United States. Approximately 640 million acres, or 28%, of the land in the United States is federally owned.[17] The USGS estimates that federal lands overlay roughly 130 million acres of usable pore space,[18] with the vast majority falling under the authority of either the Bureau of Land Management ("BLM")[19] or the United States Forest Service ("USFS").[20] Various other agencies, including the United States Fish and Wildlife Service ("USFWS") and Department of Defense ("DOD"), manage smaller portions.[21] Altogether, about 18% of pore space available for geologic

[12] *Id.* at 8-9.

[13] *Id.* at 3.

[14] U.S. GEOLOGICAL SURV. GEOLOGIC CARBON DIOXIDE STORAGE RES. ASSESSMENT TEAM, CIRCULAR 1386, NATIONAL ASSESSMENT OF GEOLOGIC CARBON DIOXIDE STORAGE RESOURCES—RESULTS 3 fig.1, 17 tbl.4, (version 1.1, 2013).

[15] *See id.* at 4 fig.2.

[16] *See PAD-US, Land Management Map*, USGS, https://www.usgs.gov/media/images/pad-us-land-management-map [https://perma.cc/XNB7-KK62] (last visited Mar. 19, 2025).

[17] CAROL HARDY VINCENT & LAURA A. HANSON, CONG. RSCH. SERV., R42346, FEDERAL LAND OWNERSHIP: OVERVIEW AND DATA 1 (version 18, 2020), https://crsreports.congress.gov/product/pdf/R/R42346/18 [https://perma.cc/HGY7-UBN4].

[18] MARC L. BUURSINK, STEVEN M. CAHAN & PETER D. WARWICK, U.S. GEOLOGICAL SURV., SCI. INVESTIGATIONS REP. 2015-5021, NATIONAL ASSESSMENT OF GEOLOGIC CARBON DIOXIDE STORAGE RESOURCES—ALLOCATIONS OF ASSESSED AREAS TO FEDERAL LANDS 1 (2015), https://pubs.usgs.gov/sir/2015/5021/pdf/sir2015-5021.pdf [https://perma.cc/8UQW-33WJ].

[19] *Id.* at 3 ("Of the assessed area overlain by Federal lands, 64 percent is managed by the BLM . . . .").

[20] *Id.* ("Of the assessed area overlain by Federal lands, . . . 21 percent is managed by the [USFS] . . . .").

[21] *Id.* ("Of the assessed area overlain by Federal lands, . . . 5.7 percent is managed by the DOD, 3.8 percent is managed by the USFWS, and 3.8 percent is managed by the NPS; other agencies manage the remaining 1.7 percent . . . .").

CO_2 sequestration is overlaid by federally owned land, not accounting for "split estate" lands where federally owned minerals underlie privately owned surface estates.[22] Federal lands with unified ownership may be particularly desirable for storage, as projects on federal land may have lower information and transaction costs compared to projects where the storage space is highly fragmented among multiple private landowners.[23]

Guidance specifying how CCS operators can obtain injection rights in federal lands is only beginning to emerge. In a 2021 report, the White House Council on Environmental Quality ("CEQ") found that "[c]larifying pore space leasing and the permitting process on Federal lands" was important to "facilitate efficient, orderly, and responsible deployment of [CCS]."[24] It suggested that, in addition to clarifying processes related to the National Environmental Policy Act ("NEPA") and the Endangered Species Act ("ESA"), "new regulations would likely be required for the Departments of Interior and Agriculture."[25] In 2022, the BLM subsequently released an instructional memorandum, IM 2022-041, that outlined basic parameters for its grants of sequestration rights,[26] and in 2023, the USFS initiated rulemaking that would modify some of its site-screening criteria to permit consideration of applications for CCS.[27] As these policies develop, millions of acres of injection rights in public land could be made available to private parties for sequestration.

Commodifying federal pore space for sequestration raises important technical and policy considerations regarding value. The Federal Land Policy and Management Act ("FLPMA") and other land management statutes and

[22] *Id.* at 2-3 ("In some areas, such as in legislatively proclaimed administrative boundaries of national forests, Federal and private surface ownerships are intermixed . . . . In other areas, such as small national wildlife refuges, the surface may be managed through easements rather than outright Federal ownership.").

[23] K.K. DuVivier & Tara Righetti, *Changing Paradigms for a Low-Carbon World*, 46 HARV. ENV'T L. REV. ONLINE 59, 66-67 (2022), https://journals.law.harvard.edu/elr/wp-content/uploads/sites/79/2022/05/46-Online-DuVivier-Righetti.pdf [https://perma.cc/M6XY-LYQ4].

[24] EXEC. OFF. OF THE PRESIDENT, COUNCIL ON ENVIRONMENTAL QUALITY REPORT TO CONGRESS ON CARBON CAPTURE, UTILIZATION, AND SEQUESTRATION 56-57 (2021), https://whitehouse.gov/wp-content/uploads/2021/06/CEQ-CCUS-Permitting-Report.pdf [https://perma.cc/57YP-7A8E].

[25] *Id.* at 42.

[26] *National Policy for the Right-of-Way Authorizations Necessary for Site Characterization, Capture, Transportation, Injection, and Permanent Geologic Sequestration of Carbon Dioxide in Connection with Carbon Sequestration Projects*, BUREAU OF LAND MGMT. (June 8, 2022) [hereinafter BLM, *Right-of-Way*], https://www.blm.gov/policy/im-2022-041 [https://perma.cc/GA4H-M5WJ].

[27] Land Uses; Special Uses; Carbon Capture and Storage Exemption, 88 Fed. Reg. 75530 (proposed Nov. 3, 2023) (to be codified at 36 C.F.R. pt. 251) (exempting CCS proposals from initial screening criterion prohibiting storage of hazardous waste on National Forest System ("NFS") lands and exclusive use and occupancy of NFS lands).

regulations require that the federal government receive fair market value when it grants use rights not generally available to the public.[28] This principle pervades irrespective of the agency or the proposed use.[29] Yet, because the demand for pore space is nascent and highly localized, and the terms of federal grants are yet undetermined, comparable sales and other established valuation methods are lacking. Understanding how federal lands can be valorized for carbon sequestration therefore requires an assessment of regulatory parameters and the ways in which the federal subsurface has been used in other contexts.

This Article considers how sequestration rights in public lands should be priced. In so doing, it makes a detailed examination of the regulations and processes related to the use of federal pore space managed by the three largest land management agencies: the Departments of Interior, Agriculture, and Defense. Part I prepares the ground for this analysis by examining the scope of public property interests in pore space and current uses of pore space. It examines federal laws and regulations related to the use of pore space for carbon sequestration, including authorities that govern the process for acquiring leasing and rights-of-way ("ROWs"), the use of pore space in association with mineral development, and rules related to trespass. Part II evaluates federal agency acquisition procedures and guidance related to valuation, drilling deep into the federal appraisal processes. With this context in place, Part III introduces a comparative approach to the valuation problem, analyzing potentially instructive precedent for subsurface and energy uses for pore space, including fluid mineral production, produced water injection, and renewable energy production. Identifying commonalities between these valuation methods, it applies them to the conceptually unique grant of rights for sequestration. It concludes with specific suggestions for valuation processes and structure and by considering the policy implications of different valuation choices. Finally, this Article takes up the question of *whether* the public should demand market values for climate related uses of public lands, and how Congress could encourage greater utilization while still protecting the public interest.

I. FEDERAL LANDS AND PORE SPACE

A. *The Reservoir Estate*

Geologic storage requires both a significant amount of pore space and confining strata capable of securely containing CO_2.[30] "Pore space" refers to the interconnected voids and structures within subsurface rocks, soils, and geologic

[28] 43 U.S.C. § 1713(d).

[29] *See id.* § 1713(a).

[30] Tara Righetti, Jesse Richardson, Kris Koski & Sam Taylor, *The Carbon Storage Future of Public Lands*, 38 PACE ENV'T L. REV. 181, 188 (2021) ("The ISO standard for geologic storage requires reservoirs with an adequate primary seal and secondary barriers to prevent CO_2 leakage.").

formations that collectively form reservoirs.[31] These CO_2 storage complexes include "deep saline aquifers, coal seams, and depleted oil or gas fields" and therefore transect both surface and mineral property interests.[32] Legally, pore space presents novel issues within common law conceptions of property. It is neither a mineral nor a tangible piece of the subsurface—but rather derives value from its ability to receive and store injected substances.[33] Within the realm of property law, as well as the halls of state legislatures, there has been significant discussion dedicated to the characterization of pore space as a distinct legal right. These discussions have centered on questions of ownership, as well as the rights to use and exclude.

Inquiries into the ownership of pore space begin with the common law maxim, "*Cuius est solum, eius est usque ad coelum et ad inferos*" ("Whoever owns land it is theirs up to the heavens and down to hell").[34] The maxim has been used to support the conclusion that a fee owner owns their property's subsurface.[35] This adage, however, merely supports the proposition that pore space *is* property. The question of ownership becomes more complex as various incidents of property are divided among owners. In a severed estate, in which the mineral and surface interests have been separately conveyed, most scholars agree that at common law the owner of the surface estate also owns the pore space underlying his or her tract of land.

A few well-settled principles of law support inclusion of pore space in the surface estate. Foremost among them is that the law of property generally presumes that a right not expressly conveyed is retained.[36] Accordingly, most conveyances of the mineral estate that are silent on conveyance of the pore space are presumed to reserve such interests to the surface owner.[37] Still, several state legislatures have found questions of ownership sufficiently ambiguous at common law to deem legislation necessary to define pore space as a property

[31] *Id.* (explaining various definitions of "pore space").

[32] *Id.*

[33] *See id.* at 192-93.

[34] *E.g.*, Laura K. Donohue, *Who Owns the Skies?* Ad Coelum*, Property Rights, and State Sovereignty*, *in* EYES TO THE SKY: PRIVACY AND COMMERCE IN THE AGE OF THE DRONE 131, 131 (Matthew Feeney ed., 2021).

[35] Owen L. Anderson, *Geologic CO_2 Sequestration: Who Owns the Pore Space?*, 9 WYO. L. REV. 97, 99 (2009). *But see* John G. Sprankling, *Owning the Center of the Earth*, 55 UCLA L. REV. 979, 981 (2008) (arguing "center of the earth approach is mere poetic hyperbole, not law" and proposing new subsurface ownership model).

[36] Anderson, *supra* note 35, at 99-100; *see also* Joseph A. Schremmer, *Crystal Gazing: Foretelling the Next Decade in Oil and Gas Law*, *in* PROCEEDINGS OF THE VIRTUAL SIXTY-SIXTH ANNUAL ROCKY MOUNTAIN MINERAL LAW INSTITUTE 5-1, 5-18 (2020) ("[T]he common law presumes that a property right not expressly conveyed is retained, and, conversely, that a right not expressly reserved is conveyed.").

[37] *See, e.g.*, Heumiller v. Hansen, 2020 S.D. 56, ¶ 15, 950 N.W.2d 426, 430 (noting in absence of explicit agreement to contrary, a conveyance imparts all benefits and burdens existing at time of conveyance).

right and regulate ownership in split estate contexts.[38] These statutes typically involve two elements: a legal definition for pore space and the creation of a presumption of ownership. North Dakota state law, for instance, defines pore space as "a cavity or void, whether naturally or artificially created, in a subsurface sedimentary stratum,"[39] whereas the Wyoming state legislature defines it as "subsurface space which can be used as storage space for carbon dioxide or other substances."[40] Both North Dakota and Wyoming, like the growing majority of states that have considered the issue, also statutorily vest ownership of the pore space in the surface owner,[41] though this rule remains a default in most cases, subject to the terms of specific conveyances.[42]

Once ownership is established, another set of issues arises from the unique geophysical nature of pore space. Pore space resources are interconnected and function as a reservoir system rather than as a set of individual parcels. As a result, injected CO_2 can migrate across property lines, forming the basis for potential trespass liability. This raises questions as to whether the rights to possess, use, and exclude are absolute or correlative and whether the property interest is corporeal or incorporeal. Several scholars describe private pore space as a common pool resource, or "limited common property," held by a limited number of owners rather than the public at large.[43] Sometimes termed "semicommon property," limited common property is nonexclusive among

[38] Jean Feriancek, *Resolving Ownership of Pore Space*, NAT. RES. & ENV'T, Winter 2012, at 49, 49 ("[O]wnership of pore space by the surface owner is considered the majority view in the United States . . . ."); *see, e.g.*, IND. CODE ANN. § 14-39-2-3 (West 2024); N.D. CENT. CODE § 47-31-03 (2025); OKLA. STAT. ANN. tit. 60, § 6 (West 2024); WYO. STAT. ANN. § 34-1-152 (2024).

[39] N.D. CENT. CODE § 47-31-02.

[40] WYO. STAT. ANN. § 34-1-152(d). While similar, these statutes include important limitations on the extent of the legislative determination of ownership. North Dakota limits its statute to sedimentary formations, thereby excluding unconventional storage resources, whereas Wyoming's statute extends only to the storage reservoir and not confining formations. N.D. CENT. CODE § 47-31-02; WYO. STAT. ANN. § 34-1-152(d).

[41] WYO. STAT. ANN. § 34-1-152(a); N.D. CENT. CODE § 47-31-03; *see also, e.g.*, CAL. PUB. RES. CODE § 71462 (West 2024); MONT. CODE ANN. § 82-11-180(3) (West 2025); OKLA. STAT. ANN. tit. 60, § 6; UTAH CODE ANN. § 40-6-20.5 (LexisNexis 2024); W. VA. CODE ANN. § 22-11B-18 (LexisNexis 2024).

[42] *See, e.g.*, IND. CODE ANN. § 14-39-2-3 ("Any ownership rights to pore space that were not expressly or by implication acquired or reserved by conveyance document remain vested in the surface estate.").

[43] Tara K. Righetti, *Correlative Rights and Limited Common Property in the Pore Space: A Response to the Challenge of Subsurface Trespass in Carbon Capture and Sequestration*, 47 ENV'T L. REP. 10420, 10433 (2017) (citing Carol M. Rose, *The Several Futures of Property: Of Cyberspace and Folk Tales, Emission Trades, and Ecosystems*, 83 MINN. L. REV. 129, 132 (1998)); *see also* Joseph A. Schremmer, *Pore Space Property*, 2021 UTAH L. REV. 1, 10.

common owners but absolute and exclusive as to all others.[44] The property interest is both semiprivate and semicommon—more akin to an incorporeal right.[45]

However, at least one court has disagreed, instead considering pore space to be a corporeal right. In a 2022 holding, the North Dakota Supreme Court in *Northwest Landowners Ass'n v. State*[46] invalidated as unconstitutional portions of a bill prohibiting a cause of action for pore space trespass.[47] It found that by allowing "third-party oil and gas operators to physically invade a landowner's property by injecting substances into the landowner's pore space," the statute "takes away one of the most treasured property rights because it takes away landowners' right to exclude oil and gas operators from trespassing and disposing waste into their pore space."[48] Citing Supreme Court jurisprudence set forth in *Loretto v. Teleprompter Manhattan CATV Corp*.,[49] the court invalidated the North Dakota statute as unconstitutionally authorizing third-party companies to physically invade property through the migration of fluids into the subsurface, thus "destroy[ing] the owner's right to possess, use, and dispose of the property."[50] This holding, which aligns with the approach taken in the draft *Restatement (Fourth) of Property*, takes a much more corporeal and absolutist view of property.[51]

B. *Federal Ownership of Pore Space*

While much attention has been directed toward the nature and character of private pore space, there has been less attention to pore space in public lands. Even where ownership is clear, understanding the nature of those rights requires a broader contextualization related to the history, acquisition, management, and purpose of federal lands, as these questions bear on whether and how federal pore space can be utilized for carbon sequestration.

The United States federal government has amassed its ample land holdings through methods of acquisition including purchase or treaty, as well as through reservations and withdrawals of land from private acquisition under various

[44] Schremmer, *supra* note 43, at 10.

[45] *Id.*

[46] 2022 ND 150, 978 N.W.2d 679.

[47] *Id.* ¶¶ 34-35, 978 N.W.2d at 695.

[48] *Id.* ¶ 26, 978 N.W.2d at 691-92.

[49] 458 U.S. 419 (1982).

[50] *Northwest Landowners Ass'n* ¶ 25, 978 N.W.2d at 691 (citing *Loretto*, 458 U.S. at 435-36).

[51] RESTATEMENT OF THE LAW (FOURTH) PROPERTY § 1.12 (AM. L. INST., Tentative Draft No. 4, 2023); Joseph A. Schremmer, *Subsurface Trespass in the* Restatement (Fourth) Of Property, 77 ALA. L. REV. (forthcoming 2026) (manuscript at 3), http://ssrn.com/abstract=4912423.

statutory[52] or nonstatutory[53] authorities. Early in the country's history, the federal government acquired large swaths from Great Britain and several of the original thirteen colonies, which ceded significant amounts of land between the Appalachian Mountains and the Mississippi River.[54] In the early 1800s, the federal government subsequently made significant and historic acquisitions from European claimants, including the Louisiana Purchase, in which France conveyed 530 million acres west of the Mississippi River.[55] Between 1818 and 1845, the federal government subsequently acquired additional lands ceded by Great Britain (portions of Minnesota and North Dakota) and Spain (Arizona, California, Florida, Nevada, and portions of New Mexico, Utah, and Wyoming), as well as lands annexed from Mexico (Texas and portions of Colorado, Kansas, New Mexico, Oklahoma, and Wyoming).[56] Additional lands were acquired from tribes.[57] Although prior grants in these early acquired lands were honored in some cases,[58] federal ownership in these acquired lands was generally deemed to be absolute.[59]

[52] The Forest Reserve Act of 1891, for instance, authorized the President of the United States to unilaterally aside forest reserves from land in the public domain. Forest Reserve Act of 1891, ch. 561, § 24, 26 Stat. 1095, 1103 (1891).

[53] Nearly 100 executive orders passed prior to 1910 established or enlarged tribal reservations. United States v. Midwest Oil Co., 236 U.S. 459, 470 (1915).

[54] *American Acquisition and Migration*, LIBR. OF CONG. (2000), https://www.loc.gov/collections/meeting-of-frontiers/articles-and-essays/colonization/american-acquisition-and-migration/ [https://perma.cc/F5SR-B6X6]; *US Territorial Acquisitions*, GLOB. POL'Y F. (2005), https://archive.globalpolicy.org/us-westward-expansion/25994.html [https://perma.cc/N4BD-E6LT]; *Territorial Acquisitions*, U.S. CENSUS BUREAU, https://www2.census.gov/programs-surveys/sis/resources/territorial-acquisitions.pdf [https://perma.cc/EW5V-KHZG] (last visited Mar. 19, 2025).

[55] *Louisiana Purchase, 1803*, OFF. OF THE HISTORIAN, https://history.state.gov/milestones/1801-1829/louisiana-purchase [https://perma.cc/ZKA2-65TK] (last visited Mar. 19, 2025); *see* Samuel Issacharoff, *Meriwether Lewis, the Air Force, and the Surge: The Problem of Constitutional Settlement*, 12 LEWIS & CLARK L. REV. 649, 654 (2008).

[56] *Territorial Acquisitions*, *supra* note 54; *see* Issacharoff, *supra* note 55, at 659.

[57] *See, e.g.*, H.R. REP. NO. 44-186, at 1-2 (1877) (describing treaty and fraudulent acquisition of Kansas Reservation Lands from Osage Nation).

[58] Pursuant to an 1807 treaty, Congress agreed to honor certain claims based on French and Spanish grants, as well as titles and preemptive (presurvey) rights acquired from predecessor colonial or state governments. Jerry L. Mashaw, *Reluctant Nationalists: Federal Administration and Administrative Law in the Republican Era, 1801-1829*, 116 YALE L.J. 1636, 1702 & n.277 (2007).

[59] Federal ownership was deemed absolute, especially relative to claims by tribes who had occupied lands for centuries or more.

> An absolute title to lands cannot exist, at the same time, in different persons, or in different governments. An absolute, must be an exclusive title, or at least a title which excludes all others not compatible with it. All our institutions recognise the absolute title

Subsequently, the government disposed of numerous of its landholdings as methods of raising revenue and encouraging settlement.[60] Initial homestead grants and land sales granted fee interests.[61] This by itself was unique compared to the land disposition practices in other western countries, including under British common law.[62] In almost every other western country at the time, the sovereign retained all minerals.[63] Beginning with the Coal Lands Act of 1909, Congress moved its land disposition practices toward this model.[64] The government began to limit its dispositions only to surface interests and to reserve some or all minerals, creating a new set of federal split estate interests.

In much of public land, the question of pore space ownership is tautological: it is owned by the "owner"—the public. Ownership of pore space is less clear in the nearly 60 million acres of split estates, where surface and mineral rights are owned separately.[65] These lands can be owned in numerous configurations of state, private, tribal, and federal land, though the most common is where some or all minerals are public and the surface is private.[66] While state law, rather than federal law, generally determines property ownership,[67] the scope of federal

> of the crown, subject only to the Indian right of occupancy, and recognise the absolute title of the crown to extinguish that right.

Johnson v. M'Intosh, 21 U.S. (8 Wheat.) 543, 588 (1823).

[60] *See* Roger D. Billings, *The Homestead Act, Pacific Railroad Act and Morrill Act*, 39 N. KY. L. REV. 699, 711 (2012).

[61] *See id.* at 700.

[62] Barry Barton, *The Common Law of Subsurface Activity: General Principle and Current Problems*, *in* THE LAW OF ENERGY UNDERGROUND: UNDERSTANDING NEW DEVELOPMENTS IN SUBSURFACE PRODUCTION, TRANSMISSION, AND STORAGE 21, 34-35 (Donald N. Zillman, Aileen McHarg, Lila Barrera-Hernández & Adrian Bradbrook eds., 2014).

[63] *See id.*

[64] Sylvia L. Harrison, Comment, *Disposition of the Mineral Estate on United States Public Lands: A Historical Perspective*, 10 PUB. LAND L. REV. 131, 148 (1989) (observing how 1909 Coal Lands Act "marked a change in the direction of the nation's mineral management policy, from liberal disposition for private exploitation to preservation for the 'public benefit'"); *see* Coal Lands Act of 1909, ch. 270, 35 Stat. 844 (codified at 30 U.S.C. § 81). The Coal Lands Act of 1909 states in part,

> Any person who has in good faith located, selected, or entered under the nonmineral land laws of the United States any lands which subsequently are classified, claimed, or reported as being valuable for coal, may . . . receive a patent therefor, which shall contain a reservation to the United States of all coal in said lands, and the right to prospect for, mine, and remove the same.

Id.

[65] *How Revenue Works: Ownership*, U.S. DEP'T OF INTERIOR: NAT'L RES. REVENUE DATA, https://revenuedata.doi.gov/how-revenue-works/ownership/ [https://perma.cc/FYJ5-TGSB] (last visited Mar. 19, 2025). *See generally* Feriancek, *supra* note 38, at 49 (noting where surface and mineral estates have been severed, surface and mineral interests are owned separately).

[66] *See generally* Buursink et al., *supra* note 18, at 2-3.

[67] Oregon *ex rel.* State Land Bd. v. Corvallis Sand & Gravel Co., 429 U.S. 363, 378 (1977).

grants and reservations is determined by Congress.[68] Moreover, for acquired lands, the relative interests of the parties could be determined according to the authorizing statute or acquisition agreement.[69] As a result, recent guidance from the BLM suggests that resolving questions about pore space ownership entails a title review in coordination with the BLM's Solicitor's Office.[70] Where there is no consensus on ownership, the question would be determined by a court.[71]

Until very recently, particular uncertainty surrounded the ownership of pore space under approximately 70 million acres of lands patented under the Stock Raising & Homestead Act of 1916 ("SRHA").[72] As the name implies, the SRHA granted land to settlers for the grazing and farming of livestock.[73] While many prior federal land disposition laws reserved the oil and gas[74] or the coal,[75] SRHA patents expressly reserve "all the coal and other minerals" to the United States.[76] While pore space is clearly not coal, prior U.S. Supreme Court precedent is less clear on whether pore space can be an "other mineral." In the 1983 case of *Watt v. Western Nuclear, Inc.*,[77] the Court interpreted this "other minerals" reservation broadly to include every "subsurface resource."[78] As a result, legal scholars have been divided on whether *Watt* would apply to determine the ownership of federal pore space,[79] suggesting the issue was bound for litigation.

[68] *See* Watt v. W. Nuclear, Inc., 462 U.S. 36, 52 (1983).

[69] *See, e.g.*, *id.* at 38-39 (noting Stock-Raising Homestead Act of 1916 set relative rights of parties with respect to "coal and other mineral deposits" in acquired land).

[70] *See* BLM, *Right-of-Way*, *supra* note 26.

[71] *See* Feriancek, *supra* note 38, at 49 ("Unless a severance deed explicitly referenced ownership of or the right to use pore space, a GCS operator would turn to case law to determine who owns pore space in the absence of a statute assigning ownership.").

[72] *See* Stock-Raising Homestead Act of 1916, ch. 9, 39 Stat. 862 (enacting law codified at 43 U.S.C. §§ 291-301). The SRHA was repealed in part by the Federal Land Policy & Management Act of 1976, Pub. L. No. 94-579, § 702, 90 Stat. 2787, 2798. Valid patents already issued under the SRHA were unaffected by the repeal.

[73] Kevin L. Doran & Angela M. Cifor, *Does the Federal Government Own the Pore Space Under Private Lands in the West? Implications of the Stock-Raising Homestead Act of 1916 for Geologic Storage of Carbon Dioxide*, 42 ENV'T L. 527, 532-33 (2012); Righetti et al., *supra* note 30, at 194.

[74] *See, e.g.*, Agricultural Entry Act of 1914, 30 U.S.C. § 121.

[75] Coal Lands Act of 1909, 30 U.S.C. § 81; Coal Lands Act of 1910, 30 U.S.C. § 83.

[76] 43 U.S.C. § 299(a).

[77] 462 U.S. 36 (1983).

[78] *Id.* at 47 ("While Congress expected that homesteaders would use the surface of SRHA lands for stockraising and raising crops, it sought to ensure that valuable subsurface resources would remain subject to disposition by the United States . . . . It did not wish to entrust the development of subsurface resources to ranchers and farmers.").

[79] Righetti et al., *supra* note 30, at 194 (providing overview of perspectives and comparing, e.g., Doran & Cifor, *supra* note 73 at 531, and Anderson, *supra* note 35, at 137).

Indeed, this question came before a federal court for the first time in 2023, after the BLM objected to a request to allow a borehole to traverse through federal minerals. In *True Oil LLC v. Bureau of Land Management*,[80] the parcel at issue was a split estate, where the surface was privately owned and the minerals were reserved pursuant to the SRHA and administered by the BLM.[81] The BLM had offered to lease the tract's minerals in 2017, but a Montana federal court vacated the leases, finding that the BLM failed to comply with sage grouse prioritization objectives in its land plan.[82] The order was appealed, subject to a prohibition on any work to "develop the leases or obtain production."[83] The owner of adjacent, private minerals and the surface of the land overlying one of the vacated federal leases then proposed a horizontal well traversing the federal leasehold.[84] The BLM notified the owner that it would be required to obtain a federal Application for Permit to Drill ("APD"), despite the fact that the well would not result in the production of federal minerals.[85] The oil and gas developer, True Oil, and the private landowner, True Ranches, sued, alleging the BLM's APD requirement would exceed the agency's statutory authority to regulate the development of federal minerals.[86]

True Oil is instructive on two points. First, it involves a split estate determination. Prior to determining whether the BLM could require an APD pursuant to regulations issued pursuant to the Mineral Leasing Act ("MLA"), the court needed to determine ownership of the pore spaces and rock structures in the formations that the borehole would traverse.[87] Consistent with the law of Wyoming and most states,[88] as well as a previous Interior Board of Land Appeals ("IBLA") decision,[89] the district court found the reservation under the SRHA encompassed "only extractable minerals . . . not the entirety of the soil

[80] 700 F. Supp. 3d 1004, 1006-07 (D. Wyo. 2023). A prior case found that a federal oil and gas lease did not grant the lessee the exclusive rights to the federal subsurface but did not opine on ownership of the underlying reservoir, instead finding that it remained the property of the "respective landowners." *See* Emeny v. United States, 412 F.2d 1319, 1323 (Ct. Cl. 1969).

[81] *True Oil*, 700 F. Supp. 3d at 1006.

[82] *Id.* at 1007.

[83] *Id.*

[84] *Id.* at 1006.

[85] *Id.*

[86] *Id.* at 1007-08.

[87] *Id.* at 1010 (describing threshold question in this case as whether SRHA extends reservation rights to all subsurface geological formations).

[88] *See* Righetti, *supra* note 43, at 10424-25.

[89] M.J. Harvey, Jr., 109 IBLA 31, 33 n.4 (1989) ("To the extent that no valuable minerals underlie ES 034022, the State of Michigan, as surface owner, owns the nonmineral strata." (citing Emeny v. United States, 412 F.2d 1319, 1323 (Ct. Cl. 1969)).

beneath the surface."[90] The decision is currently on appeal to the Tenth Circuit;[91] if upheld, the opinion would clarify that the overlying surface owner owns the pore space in split estates with federal mineral reservations, even in mineral bearing formations. This aligns with prior IBLA decisions finding that the BLM as a surface owner could require rentals for use of "subsurface void areas" for waste disposal[92] but could not require a Fluids Disposal Permit as a split estate mineral owner.[93]

Second, *True Oil* makes clear that a private owner's pore space interest in SRHA lands is not absolute. The court found that while Congress had not reserved the pore space itself, its reservation included the right to enact laws to protect its mineral interest.[94] Accordingly, the court ruled that the federal government could require an APD for a borehole through federal minerals, not because the government owned the pore space, but because its regulatory authority allowed it to infringe on the private pore space interest to protect its mineral interest.[95] This ruling aligns with emerging jurisprudence governing split estate interests in private lands, wherein courts have held the mineral owner's possessory interest in mineral bearing formations is unexclusive and subject to the surface owner's right to make use of the pore space, provided that use does not unreasonably interfere with the mineral interest.[96] While private mineral owners would be limited to injunctive relief or damages,[97] the federal mineral interest carries with it the right to exercise federal police power to protect its lands, notwithstanding that doing so may intrude on private property interests.[98] The court in *True Oil* did not rely on the agency's authority to require an APD for "development" of federal minerals,[99] but instead on its authority to prevent trespasses and assure "orderly development of oil and gas deposits."[100]

True Oil raises the additional question of whether a CCS well going vertically through federal minerals in split estate lands could be considered a traversing

[90] *True Oil*, 700 F. Supp. 3d at 1012.

[91] *See generally* Appellants' Opening Brief, True Oil LLC v. Bureau of Land Mgmt., No. 23-8082 (10th Cir. Apr. 3, 2024).

[92] Mallon Oil Co., 104 IBLA 145, 150 (1988); *cf.* Burnett Oil Co., 122 IBLA 330, 332 (1992).

[93] Phillips Petroleum Co., 105 IBLA 345, 349-50 (1988).

[94] *True Oil*, 700 F. Supp. 3d at 1013-15.

[95] *Id.*

[96] *See, e.g.*, Lightning Oil Co. v. Anadarko E&P Onshore, LLC, 520 S.W.3d 39, 47 (Tex. 2017) ("[A]lthough we agree that the surface owner owns and controls the mass of earth undergirding the surface, those rights do not necessarily mean it is entitled to make physical intrusions into formations where minerals are located and remove some of the minerals . . . .").

[97] *See id.* at 43.

[98] Camfield v. United States, 167 U.S. 518, 525 (1897).

[99] 43 C.F.R. § 3171.5 (2024).

[100] *True Oil*, 700 F. Supp. 3d at 1014.

wellbore. In *True Oil*, the court found that the APD provided the BLM with "notice of underground activities in productive mineral zones and the ability to protect future mining activities."[101] It is unclear whether the same could be extended to a traversing Class VI well. The Class VI process does not necessarily achieve these objectives or authorize denial of a permit based on the mineral owner's concerns.[102] Although an APD seems ill fitting, as do pore space ROWs and oil and gas leases, *True Oil* suggests the BLM could require some authorization to protect federal minerals from damage.[103] Because the Federal Onshore Oil and Gas Leasing Reform Act ("FOOGLRA") provides the BLM with authority to manage federal minerals in USFS lands,[104] it is possible this requirement, if any, could even apply on some federal lands.

Acquired lands also create challenging questions regarding the ownership and extent of pore space interests. Acquired lands are those that have passed out of federal ownership to private parties or states that are then repurchased by the federal government.[105] Many of these acquisitions are for specific purposes such as wildlife refuges or national grasslands.[106] The rights obtained depend on the authorizing statute and may not include the minerals.[107] While most federal

[101] *Id*. at 1015. The court's emphasis on the need to notify BLM of activities in the federal subsurface was consistent with BLM guidance released in 2020, which acknowledged the need for BLM offices to generate and maintain awareness of traversing wellbores. *Mineral Trespass to Federal and Indian Minerals*, BUREAU OF LAND MGMT. (June 10, 2020), https://www.blm.gov/policy/im-2020-028 [https://perma.cc/GL7G-262Y]. On appeal, True Oil has argued the guidance amounts to an admission by the BLM that it lacks authority to require an APD for traversing wellbores. Appellants' Opening Brief at 32, True Oil LLC v. Bureau of Land Mgmt., No. 23-8082 (10th Cir. Apr. 3, 2024).

[102] Some state Class VI rules may provide greater protection. *See, e.g.*, 020-0011-24 WYO. CODE R. §§ 22, 26 (LexisNexis 2025) (requiring owners and operators of Class VI wells to maintain financial responsibility for sites and to provide regular reports and notice of planned work or tests on well to administrator).

[103] *True Oil*, 700 F. Supp. 3d at 1014 ("Regardless if there is a specific regulation on point, it is well within the BLM's authority to regulate subsurface activity that could hinder or threaten its mineral interest.").

[104] 30 U.S.C. § 226; *see also* Memorandum of Understanding Between U.S. Dep't of the Interior Bureau of Land Mgmt. & U.S. Dep't of Agric. Forest Serv. 2 (Apr. 14, 2006); https://web.archive.org/web/20141023040639/https:/www.fs.fed.us/geology/MOU_BLM_Oil_Gas.pdf [https://perma.cc/TCC4-HH4C] ("In managing the Federal mineral estate underlying NFS lands, the BLM cooperates with the Forest Service to ensure that mutual management goals and objectives for oil and gas exploration and development activities are achieved.").

[105] VINCENT AND HANSON, *supra* note 17, at 2 n.5 (defining "acquired lands" as federal lands "obtained from a state or individual by exchange, purchase, or gift").

[106] *See* Bankhead-Jones Farm Tenant Act of 1937, ch. 517, § 32, 50 Stat. 522, 526.

[107] *Cf.* Act of Mar. 1, 1911, ch. 186, § 9, 36 Stat. 961, 962 (codified as amended at 16 U.S.C. § 518).

acquisitions are in fee,[108] acquired lands may include the opposite form of split estate as that in *True Oil*, where the federal government is the surface owner and a private party holds the minerals.[109] This is common in some eastern forests and in wildlife refuges.[110] In these lands, consistent with state law, the federal government likely holds the pore space interests as the surface owner. Its interest, however, may be larger than that of private pore space owners in split estates. As with its mineral ownership, depending on the acquisition statute and terms within the severing instruments, courts have upheld the right of the federal landowner to impose additional restrictions on mineral developers to protect the federal interest.[111]

The question of the ownership and use of federal pore space is not merely esoteric. Sequestration projects are already under review that include federal lands. In Wyoming, the Moxa Carbon Storage, Sweetwater Carbon Storage Hub, and Tallgrass Carbon Storage projects would impact, respectively, 605,091 acres,[112] 44,570 acres,[113] and 480 acres[114] of federal pore space. For at least two of these, some of the requested acreage is overlapping.[115] In Montana, the Snowy

[108] David Owens, *Land Acquisition and Coastal Resource Management: A Pragmatic Perspective*, 24 WM. & MARY L. REV. 625, 637 (1983).

[109] Dana J. Stotsky, Comment, *Taking Refuge: Policy Changes Affecting Oil and Gas Leasing on National Wildlife Refuges*, 64 OR. L. REV. 739, 756 (1986).

[110] Jonathan Thrope, Comment, Minard Run Oil Co. v. United States Forest Service, 36 HARV. ENV'T L. REV. 567, 568 (2012); *see also* Richard J. Fink, *The National Wildlife Refuges: Theory, Practice, and Prospect*, 18 HARV. ENV'T L. REV. 1, 20-21 (1994).

[111] *Compare* Duncan Energy Co. v. U.S. Forest Serv., 50 F.3d 584, 591-92 (8th Cir. 1995), *and* Dunn-McCampbell Royalty Int., Inc. v. Nat'l Park Serv., 964 F. Supp. 1125, 1136 (S.D. Tex. 1995), *with* Minard Run Oil Co. v. U.S. Forest Serv., 670 F.3d 236, 254 (3d Cir. 2011).

[112] *Southwest Wyoming CO_2 Sequestration*, BUREAU OF LAND MGMT. 1 (July 2024) [hereinafter BLM, *Southwest Wyoming*], https://eplanning.blm.gov/public_projects/2023000/200543620/20114663/251014643/1%20EATallgrassCO2SequestrationSWWyomingEA.pdf [https://perma.cc/SC5A-R56N].

[113] Press Release, Bureau of Land Mgmt., BLM Seeks Public Input on Sweetwater Carbon Dioxide Sequestration Proposal (Aug. 1, 2023), https://www.blm.gov/press-release/blm-seeks-public-input-sweetwater-carbon-dioxide-sequestration-proposal [https://perma.cc/L66B-7CZ2].

[114] Press Release, Bureau of Land Mgmt., BLM Extends Public Participation Period for Carbon Dioxide Sequestration Proposal in Laramie County (Oct. 18, 2023), https://www.blm.gov/press-release/blm-extends-public-participation-period-carbon-dioxide-sequestration-proposal-0 [https://perma.cc/5PFU-GDPY].

[115] *Compare Tallgrass Carbon Dioxide Sequestration: Southwest Wyoming*, BUREAU OF LAND MGMT. (Apr. 5, 2023), https://eplanning.blm.gov/public_projects/2023000/200549971/20076193/250082375/CO2Sequestration_SW_WY_20230405.pdf [https://perma.cc/KC7K-LNS2], *with Sweetwater Carbon Storage Hub Carbon Dioxide Sequestration*, BUREAU OF LAND MGMT. (Apr. 7, 2023), https://eplanning.blm.gov/public_projects/2024943/200559187/20082933/250089115/Sweetwater%20Carbon%20Storage%20Hub%20CO2%20Sequestration%20Map.pdf [https://perma.cc/QJ3P-57PM].

River CO_2 Sequestration Project would span over 110,100 acres, including many for surface facilities.[116]

C. *Use of Federal Land for Sequestration*

Congress derives authority to legislate public lands pursuant to the Property, Enclave, and Supremacy Clauses of the U.S. Constitution.[117] The Property Clause, the broadest of the three, provides that Congress shall have the power to "dispose of and make all needful Rules and Regulations respecting the . . . Property belonging to the United States."[118] Throughout U.S. history, Congress has exercised this authority to achieve two conflicting objectives: promoting the sale and disposal of federal land and keeping land in the public domain.[119] Congressional policy regarding public lands is carried out by a series of land management agencies, each with their own authorizing statutes and purposes. Accordingly, the policies for acquisition of federal sequestration rights differ between land management agencies based on the agency's purpose. The USFS and the BLM, for instance, are mandated to manage lands for multiple use and sustained yield, while other agencies such as the DOD and the National Park Service ("NPS") are much more constrained in how lands and natural resources are made available for utilization by private parties. This Section overviews how the principles underlying the primary land management agencies inform their prerogatives for pore space management and administration and what guidance, if any, is available regarding sequestration.

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[116] *Denbury Carbon Solutions, LLC Snowy River CO_2 Sequestration Project Information Sheet*, BUREAU OF LAND MGMT. 1 (Oct. 16, 2023), https://eplanning.blm.gov/public_projects/2026556/200564713/20087640/250093822/Denbury%20Snowy%20River%20CO2%20Sequestration%20Project_Information%20Sheet.pdf [https://perma.cc/TA2T-3AQN]. The Snowy River project has undergone an initial scoping process, involving coordination between the EPA, the U.S. Army Corps of Engineers ("USACE"), USFS, USFWS, and Bureau of Indian Affairs ("BIA"), but has been paused pending amendment to the BLM's sage grouse management plan. *Snowy River CO2 Sequestration Project*, BUREAU OF LAND MGMT., https://eplanning.blm.gov/eplanning-ui/project/2026556/510 [https://perma.cc/Z3WG-ZZC2] (last updated Sept. 23, 2024, 1:39 PM MDT).

[117] U.S. CONST. art. IV, § 3; *id.* art. I, § 8; *id.* art. VI.

[118] *Id.* art. IV, § 3.

[119] Marla E. Mansfield, *A Primer of Public Land Law*, 68 WASH. L. REV. 801, 821 (1993) ("These two types of actions historically had different meanings. A 'withdrawal' merely removed lands or resources from disposition, while a 'reservation' committed the federal lands to a specific purpose.").

1. The Department of Interior

The DOI oversees the management of an abundant amount of land in the United States,[120] including but not limited to 245 million acres administered by the BLM,[121] 95 million acres managed by the USFWS,[122] and 85 million acres comprising 431 different national park and related sites under the NPS.[123] These agencies have differing mandates that guide land management practices as relevant to CCS.

a. *Multiple-Use Public Lands*

Public lands that have not been withdrawn or designated for a specific use are managed by the BLM according to FLPMA.[124] FLPMA requires the BLM to manage its lands in conformity with principles such as multiple use, sustained yield, and preservation.[125] To facilitate the BLM's achievement of this mandate, FLPMA authorizes the BLM to grant interests in public lands to private parties in the form of ROWs and leases for various purposes.[126] These purposes include recreation, mining, oil and gas extraction, logging, grazing, hunting, wildfire mitigation, habitat conservation, off-road vehicle use, and traditional cultural uses—among others.[127] Multiple use goes beyond merely allowing for

[120] *See About Interior*, U.S. DEP'T OF THE INTERIOR, https://www.doi.gov/about [https://perma.cc/KE8J-D5WN] (last visited Mar. 19, 2025) ("The U.S. Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, Native Hawaiians, and affiliated Island Communities."). DOI provides further support to the BIA in its the management of 55 million acres of tribal trust lands. *See Bureau of Trust Funds Administration*, INDIAN AFFS., https://www.bia.gov/btfa [https://perma.cc/CMX6-GW5V] (last visited Mar. 19, 2025). However, a full evaluation of processes on BIA lands is outside the scope of this Article.

[121] *What We Manage Nationally*, BUREAU OF LAND MGMT. [hereinafter BLM, *What We Manage*], https://www.blm.gov/about/what-we-manage/national [https://perma.cc/3P45-G2Y7] (last visited Mar. 19, 2025).

[122] *Public Lands and Waters*, U.S. FISH & WILDLIFE SERV., https://www.fws.gov/library/collections/public-lands-and-waters [https://perma.cc/N247-ZLPW] (last visited Mar. 19, 2025).

[123] *About Us*, NAT'L PARK SERV., https://www.nps.gov/aboutus/national-park-system.htm [https://perma.cc/6G6W-23MZ] (last updated Jan. 17, 2025).

[124] *See* 43 U.S.C. §§ 1701-1702; BLM, *What We Manage*, *supra* note 121.

[125] 43 U.S.C. § 1701(a) ("The Congress declares that it is the policy of the United States that . . . management be on the basis of multiple use and sustained yield unless otherwise specified by law . . . .").

[126] *Id.* § 1761.

[127] *Examining the Policies and Priorities of the Bureau of Land Management, the U.S. Forest Service, and the Power Marketing Administrations: Hearing Before the Subcomm. on Energy & Min. Res. of H. Comm. on Nat. Res.*, 116th Cong. 1 (2019) (statement of Michael Nedd, Deputy Director, Operations, Bureau of Land Management); *Timber Sales*, BUREAU OF

"harmonious and coordinated management," but also requires avoiding undue degradation or permanent impairment of resources so that they can conform to changing present and future needs.[128]

In April of 2023, the BLM promulgated a controversial draft rule suggesting that public lands should be stewarded to maintain functioning, productive, and resilient ecosystems.[129] The rule, finalized in May 2024, clarifies that conservation includes protection and restoration and is "a use on par with other uses of public lands under FLPMA's multiple use framework."[130] Part of the rule requires locally appropriate restoration activities and new or revised resource management plans, but the final version removed a definition that required restoration "measures for avoiding, minimizing, rectifying, reducing, compensating for, or eliminating impacts over time."[131]

Integrating sequestration into federal lands requires an evaluation of how the practice fits into FLPMA's mandates. Carbon sequestration authorizations result in both a consumptive use and an encumbrance of federal lands. As CO_2 is injected, the available reservoir space is permanently depleted, not unlike mining.[132] While the remainder of the land would remain available for compatible uses, the reservoir estate itself has a finite yield. Unlike mining, however, in which land can be reclaimed at the end of operations and returned to multiple use, geologic storage authorizations are more hegemonic.[133] Because

LAND MGMT., https://www.blm.gov/programs/natural-resources/forests-and-woodlands/timber-sales [https://perma.cc/2SMJ-KTHT] (last visited Mar. 19, 2025); *Wildlife*, BUREAU OF LAND MGMT., https://www.blm.gov/programs/fish-and-wildlife/wildlife [https://perma.cc/N6SN-J5H4] (last visited Mar. 19, 2025); *Off-Highway Vehicles on Public Lands*, BUREAU OF LAND MGMT., https://www.blm.gov/programs/recreation/OHV [https://perma.cc/5JLD-DJ27] (last visited Mar. 19, 2025); *Cultural Heritage*, BUREAU OF LAND MGMT., https://www.blm.gov/programs/cultural-resources [https://perma.cc/5DAT-GV23] (last visited Mar. 19, 2025).

[128] 43 U.S.C. § 1702. For a differentiation between undue degradation and non-impairment, see Marla E. Mansfield, *On the Cusp of Property Rights: Lessons from Public Land Law*, 18 ECOLOGY L.Q. 43, 56-66 (1991).

[129] Conservation and Landscape Health, 88 Fed. Reg. 19583, 19586 (proposed Apr. 3, 2023) (to be codified at 43 C.F.R. pts. 1600, 6100).

[130] Conservation and Landscape Health, 89 Fed. Reg. 40308, 40320 (May 9, 2024) (to be codified at 43 C.F.R. pts. 1600, 6100).

[131] *Id.* at 40311, 40342; Conservation and Landscape Health, 88 Fed. Reg. at 19588.

[132] Mining is a well-established use that is impliedly, if not expressly, authorized on certain public lands under FLPMA's multiple use mandate. Norton v. S. Utah Wilderness All., 542 U.S. 55, 58 (2004) ("'Multiple use management' . . . describes the enormously complicated task of striking a balance among the many competing uses to which land can be put, 'including, but not limited to, recreation, range, timber, minerals, watershed, wildlife and fish, and [uses serving] natural scenic, scientific and historical values.'" (alteration in original) (quoting 43 U.S.C. § 1702(c))).

[133] *See Mission and Vision Statements*, OFF. OF SURFACE MINING RECLAMATION & ENF'T, https://www.osmre.gov/about/mission-and-vision [https://perma.cc/YWW5-VBZN] (last visited Mar. 19, 2025).

the Class VI program prohibits actions that could lead to a loss of containment, future use of the land would perpetually be subject to noninterference standards.[134] This limits the scope of the federal estate going forward. Carbon sequestration then includes aspects of both permanent disposal and conservation. While depletive, the use of the land for storage could offset or eliminate emissions impacts from other land uses.

Geologic storage proposals on federal land would have to be tailored to mitigate impacts and prevent "unnecessary or undue degradation" of public lands.[135] Agencies are required to reject any proposed action that would violate this standard. [136] This is not a standard of nonuse or nondegradation. Instead, courts have interpreted this requirement as prohibiting unnecessary harms and impacts that exceed those "anticipated from appropriately mitigated development."[137] Degradation can result both from omissions, such as failure to mitigate harm or to reclaim disturbed areas, and actions, such as violating environmental laws or creating a nuisance.[138]

Multiple-use lands present an innate possibility of conflicts between uses. Even if there is federal ownership in fee, development of pore space will require consideration of the relative rights and priorities between the sequestration operator and other federal permittees. The multiple-use mandate applicable to federal lands also implicates the possibility of conflicts between sequestration and other subsurface uses.[139] In many areas, the subsurface is not virgin territory: It is already occupied and in use for mineral production, waste disposal, and other purposes.[140] Where the federal government is a fee owner of the land, the multiple-use mandate requires that, to the maximum extent possible, these uses of the subsurface coexist.[141]

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[134] *See Class VI - Wells Used for Geologic Sequestration of Carbon Dioxide*, EPA, https://www.epa.gov/uic/class-vi-wells-used-geologic-sequestration-carbon-dioxide [https://perma.cc/PYW2-4QXQ] (last updated Jan. 17, 2025).

[135] 43 U.S.C. § 1732(b).

[136] *See id.* § 1765; 43 C.F.R. § 2801.2 (2024).

[137] *See* Sandra B. Zellmer & Robert L. Glicksman, *A Critical 21st Century Role for Public Land Management: Conserving 30% of the Nation's Lands and Waters Beyond 2030*, 54 ARIZ. ST. L.J. 1313, 1360 (2022) (quoting Theodore Roosevelt Conservation P'ship v. Salazar, 661 F.3d 66, 76 (D.C. Cir. 2011)); Min. Pol'y Ctr. v. Norton, 292 F. Supp. 2d 30, 35 (D.D.C. 2003).

[138] Gregory M. Adams, *Bringing Green Power to the Public Lands: The Bureau of Land Management's Authority and Discretion to Regulate Wind-Energy Developments*, 21 J. ENV'T L. & LITIG. 445, 472-73 (2006).

[139] Joseph A. Schremmer, *The Concurrent Use of Land for Carbon Sequestration and Mineral Development*, 75 BAYLOR L. REV. 630, 635-36 (2024).

[140] *Id.* at 695.

[141] *See* Anderson, *supra* note 35, at 99; 43 U.S.C. § 1701.

Conflicts between subsurface users have previously arisen among developers of coal, oil and gas, and other minerals.[142] At times, these minerals may be coterminous, where production of one is impossible without damage or interference to the other.[143] Congress has provided the BLM with two possible approaches for resolving these types of conflicts. The first approach is accommodation.[144] With passage of the Multiple Mineral Development Act of 1954, Congress directed that mining claimants and mineral lessees, as reasonably practicable, should conduct operations to be compatible with multiple use and to not materially interfere with one another.[145] This creates mutual obligations of accommodation, where no resource is inherently prioritized over another—neither by priority (first in time) nor by the physical relationship nor relative value of the resource. The second approach is through a congressional dominant-use designation and noninterference. For example, within the withdrawn strategic helium reserves, the Multiple Mineral Development Act allows for later entry under the mining laws, provided that the entrant can illustrate there was no reasonable probability for the operations to "result in the extraction or cause loss or waste of the helium-bearing gas."[146] This creates a dominant use of the land that must be protected going forward.

The BLM has suggested it will incorporate these principles of accommodation and noninterference into the terms of leases of sequestration ROWs.[147] Noninterference provisions are already customarily incorporated into federal mineral leases. These lease provisions expressly allow for overlapping leases and simultaneous operations while requiring the grantee to avoid unreasonably interfering with other authorized uses.[148] As with federal mineral leases, the BLM's instruction memorandum ("IM") suggests that the ROW for pore space injection would require the ROW holder to avoid interference with or damage to other surface and subsurface authorized uses, including mineral production.[149]

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[142] *See, e.g.*, Jan G. Laitos & Elizabeth H. Getches, *Multi-layered, and Sequential, State and Local Barriers to Extractive Resource Development*, 23 VA. ENV'T L.J. 1, 3-4 (2004) (noting many layers of state and local regulations create confusion amongst coal, oil, and gas developers and mineral estate owners about whose property rights prevail and which laws should apply to development projects).

[143] Phillip Wm. Lear & J. Matthew Snow, *Coal and Coalbed Methane Development Conflicts Revisited: The Oil and Gas Perspective*, *in* ROCKY MOUNTAIN MINERAL LAW SPECIAL INSTITUTE: PUBLIC LAND LAW, REGULATION, AND MANAGEMENT § 10 (2003).

[144] 30 U.S.C. §§ 521-531.

[145] *See id.*

[146] *Id.* § 529; Harold S. Bloomenthal, *Multiple Mineral Development on the Public Domain*, 9 WYO. L.J. 139, 154 (1955).

[147] *See* BLM, *Right-of-Way*, *supra* note 26.

[148] *See, e.g.*, 43 C.F.R. § 3250.11 (2024) (addressing geothermal leases).

[149] BLM, *Right-of-Way*, *supra* note 26. If an application for an overlapping ROW were received, the BLM would notify the existing grantee and consider its recommendations for how to manage the conflict pursuant to 43 C.F.R. § 2807.14 (2024). Issues would remain. For

Noninterference alone, however, does not fully resolve the issue. While it may account for conflicts among contemporary users, it would not address long-term conflicts from long-term stewardship. Once injection begins, the property must be carefully managed to prevent losses of containment and leakage.[150] To address this, the IM specifies the BLM can only authorize other uses if they would not interfere with the sequestration project.[151] Doing so, however, creates the second problem: the possibility of nondevelopment of other federal resources, thereby increasing the opportunity cost of sequestration.[152] To hedge against this possibility, the IM requires preparation of mineral potential reports prior to issuance of any sequestration ROW and requires stipulations that would prevent damage to mineral resources.[153]

Although Congress provided direction to the BLM regarding helium lands, land managers also balance and prevent conflicting uses through the land planning process.[154] Managing for multiple use means juggling between consumptive and nonconsumptive uses.[155] At times, these may be incompatible. For example, while an open pit mine and public recreation facilities may both be appropriate uses of public land, they cannot both exist in the same place. The BLM makes choices about use through a comprehensive and "mind-numbingly complex" land planning process, which includes extensive public engagement, cross-agency collaboration, and environmental reviews.[156] The resulting Resource Management Plans ("RMPs") serve as land management blueprints

instance, the injection well program can require the sequestration operator to reenter and perform corrective action on existing wells that may be owned by other federal permittees, which would require interference.

[150] *See, e.g.*, Kevin Bisdom & Alvin W. Chan, *De-risking Fault Leakage Risk and Containment Integrity for Subsurface Storage Applications*, ISCIENCE 1 (June 21, 2024), https://www.sciencedirect.com/science/article/pii/S2589004224011799 [https://perma.cc/5UMG-NNSH] (noting for carbon capture and sequestration to be successful, storage spaces must be managed to prevent carbon dioxide leakage).

[151] *See* BLM, *Right-of-Way*, *supra* note 26.

[152] Casey R. Terrell, *Howdy, Neighbor! Navigating Co-development of Energy Projects on Federal Lands*, WYO. LAW., June 2022, at 28, 28, 30. While the government may not always intervene as the landowner to mediate disputes, the Class VI regulations in Wyoming would require the applicant to demonstrate that the proposed project would not impair mineral development. *See* 020-0011-08 WYO. CODE R. § 6(c)(ii) (LexisNexis 2025).

[153] *See* BLM, *Right-of-Way*, *supra* note 26.

[154] A recent report of the Interagency Working Group on Mining Laws, Regulations, and Permitting suggested that resource conflicts should be avoided through programmatic planning. *See* INTERAGENCY WORKING GRP. ON MINING LS., REGULS., AND PERMITTING, RECOMMENDATIONS TO IMPROVE MINING ON PUBLIC LANDS 7 (2023), https://www.doi.gov/sites/default/files/mriwg-report-final-508.pdf [https://perma.cc/25XP-362B].

[155] Mark Squillace, *Rethinking Public Land Use Planning*, 43 HARV. ENV'T L. REV. 415, 423 (2019).

[156] *Id.* at 416, 426.

that control how multiple-use public lands are used, until they are either revised or periodically revisited.[157]

The facts leading up to *Barlow & Haun, Inc. v. United States*[158] provide an example of how land planning can resolve multiple resource conflicts through a phased-development approach.[159] In that case, the BLM issued oil and gas leases in the same areas where it had issued leases for the development of trona, a sodium-rich mineral that is processed into sodium ash and used in numerous industrial and household applications.[160] Trona is produced through underground mining and in only one known area of the United States—an area that also happened to be subject to oil and gas leases.[161] The BLM began developing a Conflict Policy to address concerns about concurrent development of the land, but it paused this effort to review an alternative proposed by the Joint Industry Committee ("JIC").[162] After reviewing the JIC's recommendations, the BLM proposed suspending leases indefinitely to prioritize trona mining.[163] After receiving feedback on a draft version, the BLM promulgated its proposed RMP and Environmental Impact Statement ("EIS") that acknowledged existing land rights, but put limits on oil and gas development within the Mechanically Mineable Trona Area ("MMTA").[164] This provides one example of how the RMP process can be used to manage conflicts. Although the federal mining and oil and gas estates are considered on "equal footing," rather than in a dominant-servient order, where operations are incompatible, the agency may "time phase"

[157] For instance, in 2020, CEQ reported that the average Environmental Impact Statement ("EIS") completion time is 4.5 years. *See* COUNCIL ON ENV'T QUALITY, EXEC. OFF. OF THE PRESIDENT, ENVIRONMENTAL IMPACT STATEMENT TIMELINES (2010-2018) 1 (2020), https://ceq.doe.gov/docs/nepa-practice/CEQ_EIS_Timeline_Report_2020-6-12.pdf [https://perma.cc/Q3QU-EJ3J]. Given § 45Q's current beginning-of-construction deadline of January 1, 2033, CEQ has recommended the BLM and other relevant agencies consider the use of programmatic environmental analyses to improve efficiencies in the review of CCS projects. I.R.C. § 45Q; *see, e.g.*, Carbon Capture, Utilization, and Sequestration Guidance, 87 Fed Reg. 8808, 8809 (Feb. 16, 2022). The revision of an RMP most often requires preparation of an EIS resulting in time-consuming and costly reviews. *See* CEQ, *supra*, at 1-3, 5.

[158] 805 F.3d 1049 (Fed. Cir. 2015).

[159] *Id.* at 1055.

[160] *Id.* at 1052-53.

[161] *Id.* at 1053.

[162] Barlow & Haun, Inc. v. United States, 118 Fed. Cl. 597, 607 (2014), *aff'd*, 805 F.3d 1049 (Fed. Cir. 2015) (describing how several parties interested in using the land formed JIC and proposed alternative to BLM's Conflict Policy).

[163] *Id.*

[164] *Id.* at 610. The current RMP revision process suggests continuing the suspension of existing leases and closing a large area of the MMTA for further oil and gas leasing. *See* ROCK SPRINGS FIELD OFF., BUREAU OF LAND MGMT., 1 DRAFT RESOURCE MANAGEMENT PLAN REVISION AND DRAFT ENVIRONMENTAL IMPACT STATEMENT 2-28 (2023), https://eplanning.blm.gov/public_projects/13853/200030619/20084073/250090255/Volume%201_Rock%20Springs%20RMP%20Revision%20Draft%20EIS_v2.pdf.

resource development to prevent waste, providing for sequential use, rather than simultaneous use.[165]

b. *Dominant-Purpose Lands*

Unlike multiple-use lands, many other lands managed within the DOI are designated for specific purposes. These dominant-use lands include lands managed by the USFWS and the NPS.[166] On these lands, Congress has designated a dominant use, and other uses are only permitted to the extent that they are compatible with that dominant use.[167]

The USFWS is one example of a dominant-use agency.[168] Its mission is "to conserve, protect, and enhance fish, wildlife, and plants, and their habitats for the continuing benefit of the American people."[169] It has regulatory, law enforcement, and land management authority pursuant to authorizing legislation that includes the Endangered Species Act,[170] the Lacey Act,[171]and the Migratory Bird Treaty Act.[172] USFWS further manages lands for the benefit and enhancement of fish and wildlife through the National Wildlife Refuge System pursuant to the National Wildlife Refuge System Administration Act.[173]

USFWS manages wildlife refuges according to Comprehensive Conservation Plans.[174] These Conservation Plans are specific to each refuge or planning unit

[165] Phillip Wm. Lear, *Multiple Mineral Development Conflicts: An Armageddon in Simultaneous Mineral Operations?*, *in* PROCEEDINGS OF THE ROCKY MOUNTAIN MINERAL LAW TWENTY-EIGHTH ANNUAL INSTITUTE ch. 2 (1982); Phillip Wm. Lear & Stephanie Barber-Renteria, *Split Estates and Severed Minerals: Rights of Access and Surface Use After the Divorce (and Other Leasehold Access-Related Problems)*, *in* PROCEEDINGS OF THE ROCKY MOUNTAIN MINERAL LAW FIFTY ANNUAL INSTITUTE § 10 (2004); Yates Petroleum Corp., 176 IBLA 144, 155 (2008).

[166] Squillace, *supra* note 155, at 417.

[167] Robert L. Glicksman, *Wilderness Management by the Multiple Use Agencies: What Makes the Forest Service and the Bureau of Land Management Different?*, 44 ENV'T L. 447, 448 (2014).

[168] Squillace, *supra* note 155, at 417.

[169] *About Us*, U.S. FISH & WILDLIFE SERV., http://www.fws.gov/help/about_us.html [https://perma.cc/KES5-M2B8] (last visited Nov. 11, 2024); *U.S. Fish and Wildlife Service: An Overview*, EVERYCRSREPORT.COM, https://www.everycrsreport.com/reports/R45265.html [https://perma.cc/4UB8-LNA8] (last updated Mar. 19, 2025) (stating USFWS oversees approximately 856 acres of space, including land under primary or secondary jurisdiction, submerged lands, and waters, with 146 million of those acres in national wildlife refuges and 705 million acres in marine national monuments).

[170] 16 U.S.C. §§ 1531-1544.

[171] *Id.* §§ 3371-3378; 18 U.S.C. §§ 42-43.

[172] 16 U.S.C. §§ 703-712. USFWS is likely to be involved in decisions on other federal lands to the extent proposed injection activities implicate one or more endangered or threatened species.

[173] *Id*. §§ 668dd-668ee.

[174] *Id.* § 668dd.

and are revised at least every fifteen years.[175] USFWS has not addressed the possibility of carbon storage on lands under its jurisdiction through the Conservation planning process. New proposals for CCS uses would therefore require a compatibility determination.[176] Compatibility determinations include a consideration of the proposed use, anticipated costs and impacts, potential mitigating stipulations, and whether the proposed action would "materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purpose(s) of the national wildlife refuge."[177] Additionally, public and private economic uses, including ROWs, are only permitted where they contribute "to the achievement of the national wildlife refuge purposes."[178] The only exception is where nonfederal minerals underlie USFWS lands.[179] In that case, operations must be conducted to minimize damage to USFWS lands or disturbance of wildlife.[180]

The NPS is another dominant-use agency within the DOI.[181] It was created through the Organic Act of 1916 to manage a new national parks system consisting of parks, national monuments, and other national reservations primarily to "conserve the scenery, natural and historic objects, and wild life in the System units and to provide for the enjoyment of the scenery, natural and historic objects, and wild life in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."[182] With a fundamental purpose of managing, conserving, and maintaining the natural, historic, and scenic environment of lands for public use and enjoyment, the NPS has only limited authority to permit the private commercial use of the lands within its jurisdiction.[183]

Dominant-use lands[184] pose a particular challenge for CCS. The dominant purpose for which the land has been designated may or may not be compatible

[175] *Id.*

[176] 50 C.F.R. § 26.41 (2024).

[177] *Id.* § 26.41(a).

[178] *Id.* § 29.1.

[179] *Id.* § 29.32.

[180] *Id.*; R. ELIOT CRAFTON, MARC HUMPHRIES & LAURA B. COMAY, CONG. RSCH. SERV., R45192, OIL AND GAS ACTIVITIES WITHIN THE NATIONAL WILDLIFE REFUGE SYSTEM 2 (version 3, 2018), https://crsreports.congress.gov/product/pdf/R/R45192/3 [https://perma.cc/8GFJ-MALW].

[181] Sandra B. Zellmer, *Wilderness Management in National Parks and Wildlife Refuges*, 44 ENV'T L. 497, 497 (2014) (noting NPS and USFWS are the two dominant-use land management agencies in United States).

[182] 54 U.S.C. § 100101(a).

[183] *See* Organic Act of 1916, ch. 408, 39 Stat. 535 (codified at 54 U.S.C.).

[184] These lands also include lands managed for hydropower and water infrastructure by the Bureau of Reclamation and lands withdrawn from multiple use for military or other purposes. *See About Us - Fact Sheet*, BUREAU OF RECLAMATION, https://www.usbr.gov/main/about/fact.html [https://perma.cc/TM34-EXQR] (last updated Jan. 19, 2024). Withdrawn

with CCS. Dominant-use lands may require that the proposed secondary use not only be compatible with the dominant use, but also enhance the specific purposes for which the land is designated.[185] For example, both USFWS and NPS regulations require to some extent that private land uses benefit the refuge or park and advance the primary purpose for which the land was set aside.[186] While CCS projects support general climate mitigation—which indirectly will benefit both park ecology and wildlife—this alone may not justify installation of sequestration facilities on the land. However, sequestration rights could potentially be granted with no-surface-occupancy stipulations allowing only for injection from locations off federal lands.[187]

Finally, the DOI also serves an important land management function as trustee over approximately 56 million surface acres in the United States, managed by the Bureau of Indian Affairs ("BIA") on behalf of tribes and individual trust-account beneficiaries.[188] Tribal lands present unique considerations in terms of pore space ownership and management structures relative to land use and economic development strategies. Although federally managed, tribal lands are not public and are not designated as multiple-use lands. On these lands, the BIA's fiduciary obligation as trustee is to protect treaty rights, preserve resources, and provide for efficient management.[189] To obtain a ROW, the applicant must obtain consent of the tribe or the majority of tribal landowners.[190]

lands include congressional withdrawals, administrative withdrawals, presidential proclamation withdrawals, and Federal Power Act or Federal Energy Regulatory Commission withdrawals. *See Withdrawals*, U.S. BUREAU OF LAND MGMT., https://www.blm.gov/programs/lands-and-realty/withdrawals [https://perma.cc/VYA7-QCEP] (last visited Mar. 19, 2025).

[185] 50 C.F.R. § 26.41 (2024).

[186] *Id.*

[187] No-surface occupancy leases do not involve an "irreversible and irretrievable commitment of resources." N. Alaska Env't Ctr. v. U.S. Dep't of the Interior, 983 F.3d 1077, 1086 (9th Cir. 2020). Similarly, in National Wildlife Refuges, wells drilled from outside refuges or on nonfederal inholdings are not subject to regulations governing operations within the refuge system. *See* 50 C.F.R. § 29.80 (2024). The 9B regulations in some situations allow for directional drilling into areas managed by the NPS. *See* Sierra Club v. Mainella, 459 F. Supp. 2d 76, 77 (D.D.C. 2006); 36 C.F.R. § 9.71 (2024).

[188] Robert McCarthy, *The Bureau of Indian Affairs and the Federal Trust Obligation to American Indians*, 19 BYU J. PUB. L. 1, 14 (2004) ("The [BIA's] responsibility is the administration and management of 55.7 million acres of land held in trust by the United States for American Indians, Indian tribes, and Alaska Natives." (alteration in original) (quoting *Bureau of Indian Affairs*, DOI, https://web.archive.org/web/20040606141412/http://www.doi.gov/bureau-indian-affairs.html (last visited Mar. 19, 2025))).

[189] 25 C.F.R. § 169.107 (2024); McCarthy, *supra* note 188, at 18.

[190] 25 C.F.R. § 169.107.

2. The Department of Agriculture

Approximately 193 million acres of federal lands in the United States consist of National Forests,[191] which are managed by the USFS within the Department of Agriculture pursuant to the requirements set forth by the National Forest Management Act ("NFMA") and other management statutes.[192] Similar to BLM lands, these statutes require managing National Forest System ("NFS") lands for multiple use and sustained yield.[193] According to the Multiple-Use Sustained-Yield Act, this mandate requires the USFS to manage lands "in the combination that will best meet the needs of the American people" that achieves and maintains "a high-level annual or regular periodic output of the various renewable resources of the national forests without impairment of the productivity of the land."[194] The Secretary is required to inventory these lands—and new and emerging resources and values—on a continuing basis.[195] As with the BLM, USFS lands are also subject to comprehensive planning on a unit-level basis. The NFMA, along with the Forest and Rangeland Renewable Resources Planning Act of 1974, requires development and periodic amendment of land management plans for lands within the NFS.[196] The planning processes require an interdisciplinary approach that considers biological and economic information as well as extensive public participation.[197] As of 2012, the predominant planning rule was amended and requires the USFS to consider ecosystem protection and to adapt forest plans to changing conditions, including climate change.[198] These plans provide long-term management direction for the resources and uses within specific national forest areas.[199] Although not currently contemplated by USFS plans or resource assessments, sequestration may be compatible with forest service principles of multiple use and sustained yield.

Within national forests, areas may be removed from multiple use by wilderness or other designations.[200] Authorized by the Wilderness Act of

[191] Information Collection: Special Use Administration, 85 Fed. Reg. 57181, 57181 (Sept. 15, 2020).

[192] Multiple-Use Sustained-Yield Act of 1960, Pub. L. No. 86-517, 74 Stat. 215 (codified at 16 U.S.C. §§ 528-531); Forest and Rangeland Renewable Resources Planning Act of 1974, Pub. L. No. 93-378, 88 Stat. 476 (codified as amended at 16 U.S.C. §§ 1600-1609).

[193] 16 U.S.C. §§ 473-482.

[194] *Id.* § 531.

[195] *Id.* § 1603.

[196] *Id.* §§ 1600-1614.

[197] *Id.* § 1612.

[198] 36 C.F.R. § 219.5(a) (2024).

[199] *See Planning Rule Overview Page*, FOREST SERV., https://www.fs.usda.gov/planningrule (last visited Mar. 19, 2025).

[200] The primary purpose of the Wilderness Act is to preserve the wilderness character of wilderness areas and allow land-administration agencies to recommend heightened protection

1964,[201] agencies managed wilderness lands to "promote, perpetuate, and, where necessary, restore the wilderness character of the land and its specific values of solitude, physical and mental challenge, scientific study, inspiration, and primitive recreation."[202] To preserve the designated wilderness area's primitive character, commercial enterprises, roads of any kind, motorized transport, structures and installations, and tree cutting are prohibited.[203] Temporary structures are authorized only as necessary for recreation and wilderness purposes.[204] Similar to national parks, and in contrast to most other forest administrative units,[205] sequestration activities would be incompatible with wilderness areas unless they were subject to a stipulation prohibiting use or occupancy of the surface.

3. The Department of Defense

The DOD owns, leases, or otherwise manages over 26 million acres of land in the United States, with land holdings spanning 538 installations.[206] The DOD's parcel ownership ranges from small parcels of less than one acre to significant parcels of over a million acres.[207] The Army Corps of Engineers administers 12 million acres, approximately half of the total area of these lands.[208]

for areas within their jurisdiction. 16 U.S.C. § 1131. Today, the U.S. Fish and Wildlife Service, NPS, BLM and USFS cooperatively manage more than 800 wilderness areas. *Wilderness Act of 1964*, U.S. FISH & WILDLIFE SERV., https://www.fws.gov/law/wilderness-act-1964[https://perma.cc/A39G-6SH6] (last visited Mar. 19, 2025).

[201] 16 U.S.C. § 1131.

[202] 36 C.F.R. § 293.2.

[203] *Id.* § 293.6.

[204] *Id.* § 293.8.

[205] *Id.* § 212.1.

[206] *Department of Defense (DOD)*, BROADBANDUSA, https://broadbandusa.ntia.doc.gov/resources/federal/federal-permitting/department-defense-dod [https://perma.cc/AF7T-DW39] (last visited Mar. 19, 2025) (showcasing DOD's "real property portfolio consisting of over 568,000 facilities on nearly 27 million acres at over 4,790 sites worldwide," including Air Force's over 1,750 sites and nearly 98,000 facilities, Army's over 1,500 sites and over 230,000 facilities, and Navy's nearly 800 sites and over 110,000 facilities); Joseph Clark, *DOD Releases Strategy to Build Resilient, Healthy Environments for Service Members and Families*, U.S. DEP'T OF DEF. (Feb. 16, 2024), https://www.defense.gov/News/News-Stories/Article/Article/3679385/dod-releases-strategy-to-build-resilient-healthy-environments-for-service-membe/ [https://perma.cc/99AY-XCUN] (illuminating DOD's expansive "infrastructure footprint" with 538 installations worldwide and "open spaces on military installations including outdoor recreation spaces, parks, waterways and protected areas").

[207] VINCENT & HANSON, *supra* note 17, at 6.

[208] Mike Case, *15 Things You Should Know About the Army Corps of Engineers*, USO (June 10, 2022), https://www.uso.org/stories/2375-15-things-you-should-know-about-the-

Defense lands, waters, airspace, and cultural resources are intended almost exclusively for the purpose of supporting mission-related activities.[209] However, in limited situations, defense lands can be made available for either private use or for conservation purposes. While the DOD, like other agencies, is encouraged to repurpose or dispose of excess property,[210] nonexcess defense property can be made available for private uses that are consistent with defense purposes.[211] For example, by statute, defense lands may be leased if the Secretary of a military department finds it will either promote national defense or be in the public interest.[212] Similarly, provided it is not against the public interest, the Secretary is authorized to grant easements for certain specific purposes, including railroads, flumes, ditches, communication towers, dams, and reservoirs, as well as "any other purpose that the Secretary considers advisable."[213] The Office of the Deputy Assistant Secretary of Defense for Energy has identified this authority as one option to pursue greater energy resilience.[214] Although conservation is not the primary objective of defense lands, DOD lands can be used for conservation-related program activities necessary to sustain "long-term ecological integrity" for realistic military training and testing, mission readiness, and range sustainability.[215] To those ends, sequestration projects must be in compliance with existing environmental regulations and laws.[216]

army-corps-of-engineers-for-it-s-birthday [https://perma.cc/D6K6-SJ3W] (noting Army Corps of Engineers "oversees 400 lake and river projects in 43 states, 12 million acres of public lands and over 93,000 campsites").

[209] DEP'T OF DEF., DOD INSTRUCTION 4715.03: NATURAL RESOURCES MANAGEMENT 4 (2024), https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/471503p.pdf [https://perma.cc/5KVG-SDXQ].

[210] VINCENT & HANSON, *supra* note 17, at 18-19.

[211] *See* Douglas E. DeVore II, *The History and Development of 10 U.S.C. § 2667 and Its Use in Managing Air Force Real Property*, 72 A.F. L. REV. 161, 197-98 (2015) (observing proceeds collected through leasing defense property have been allocated toward underfunded maintenance, repair services, and environmental restoration accounts).

[212] 10 U.S.C. § 2667(a). The conditions on leases, however, may be inconsistent with operational needs for CCS. For example, leases must reserve the right of the Secretary to revoke at any time. *Id.* § 2667(b)(3).

[213] *Id.* § 2668(a).

[214] OFF. OF THE ASSISTANT SEC'Y FOR DEF., GUIDANCE ON THE USE OF EASEMENTS IN PURSUING ENERGY RESILIENCE (2020), https://perma.cc/KM3J-5X3Q.

[215] DOD, *supra* note 206, at 4-5.

[216] *Id.* at 26. For example, under 10 U.S.C. § 2692, the storage, treatment, and disposal of nondefense "toxic and hazardous materials" is prohibited without an exception from the Secretary of the military department concerned. While the EPA has conditionally excluded geologically stored CO_2 in Class VI wells from the definition of a hazardous waste, this exclusion might limit other storage activities in Class II wells. 40 C.F.R. § 261.4(h) (2024); ANGELA C. JONES, CONG. RSCH. SERV., R46192, INJECTION AND GEOLOGIC SEQUESTRATION

The DOD manages these installation-specific goals on an administrative unit basis through a planning process. Master plans are required for all major military installations.[217] These include both environmental and real property master planning.[218] For the Department of the Navy and Department of the Army, natural resource and cultural values are assessed through preparation of an Integrated Natural Resources Management Plan ("INRMP").[219] These planning processes are subject to NEPA.[220] INRMPs are reviewed annually and updated every five years for alignment with military mission and environmental requirements.[221] As with other NEPA processes, this provides opportunities for intergovernmental coordination and public scoping and comment.[222] Decisions about land use on specific installations would be informed by the master plans.

Defense regulations may therefore provide a limited pathway for sequestration projects on defense lands, provided that the infrastructure or access requirements of the project are not inconsistent with mission purposes. Sequestration could be seen as both in the public interest and, though admittedly more tenuously, as necessary for long-term ecological integrity. As part of its decarbonization plan, the DOD has raised the potential usefulness of sequestration. In April of 2023, the DOD released the *Department of Defense Plan to Reduce Greenhouse Gas Emissions*, which described the DOD's intent to "partner with private industry and other federal agencies to explore ways to store large amounts of carbon in rock or salt formations beneath DoD lands."[223]

D. *Trespasses into Federal Pore Space*

Using federal lands for geologic sequestration without a ROW or other grants of interest could constitute a trespass. The BLM regulations define trespass as "using, occupying, developing, or subleasing the public lands or their resources

OF CARBON DIOXIDE: FEDERAL ROLE AND ISSUES FOR CONGRESS 16 (version 5, 2022), https://crsreports.congress.gov/product/pdf/R/R46192 [https://perma.cc/A956-CMW3].

[217] 10 U.S.C. § 2864.

[218] *Id.* § 2864(a); *see also* DEP'T OF THE ARMY, AR 210-20, REAL PROPERTY MASTER PLANNING FOR ARMY INSTALLATIONS 1 (2005), https://www.moore.army.mil/garrison/dpw/content/pdf/AR210-20.pdf [https://perma.cc/35L2-VRLV] (establishing Army's policies and responsibilities associated with implementation of real property master planning process and stressing "vital relationship" between real property master planning and environmental planning).

[219] 32 C.F.R. §§ 775.6(f)(45)-(46), 651.10(b) (2024). The Department of the Air Force uses an "Environmental Impact Analysis Process." *Id.* § 989.

[220] Each department has regulations related to the implementation of NEPA. *See, e.g.*, *id.* §§ 651, 775, 989 (incorporating prolific references to NEPA in discussion of military planning processes).

[221] DOD, *supra* note 206, at 11, 13.

[222] DEP'T OF THE ARMY, *supra* note 218, at 3, 10-11.

[223] U.S. DEP'T OF DEF., DEPARTMENT OF DEFENSE PLAN TO REDUCE GREENHOUSE GAS EMISSIONS 17 (2023), https://media.defense.gov/2023/jun/16/2003243454/-1/-1/1/2023-dod-plan-to-reduce-greenhouse-gas-emissions.pdf [https://perma.cc/KQ3B-8H8H].

without a required authorization" or "acts or omissions causing unnecessary or undue degradation to the public lands or their resources" resulting from land uses outside the area of activity.[224] Trespass can occur by conscious act, mistake, or inadvertence.[225] Clearly, the location of any geologic sequestration facilities on public land would constitute a trespass.[226] However, the application of BLM regulations to indirect migration and pressure increases is less clear.[227] Returning to *True Oil*, discussed in Section I.B, the BLM took the approach that its mineral interest gave it an absolute right to exclude location of physical infrastructure in its subsurface.[228] Yet, for indirect trespasses resulting from fluid or gas migration, the BLM has taken a different approach. For example, injection facilities for produced water disposal are frequently located adjacent to federal lands.[229] Notwithstanding that this would constitute an occupation of the federal storage resource, neither case law nor IBLA decisions includes an example of where the BLM has required a ROW for plume migration or pursued remedies under its trespass regulations.[230]

Pressure increases could also result in trespass liability under the undue degradation standard. Where undue degradation results from uses off federal lands, FLPMA empowers the BLM to protect the federal interest through trespass regulations.[231] When CO_2 is injected, it displaces the existing gasses and fluids in the reservoir. This causes the pressure in the formation in the areas

[224] 43 C.F.R. § 2808.10(a)-(b) (2024).

[225] *Id.* § 2808.10(c).

[226] *Id.* § 2808.10(a)-(b).

[227] The BLM has indicated in communications with operators that indirect migration of CO_2 into federal lands would be considered a trespass. *See* Letter from Douglas D. Linn, Acting Deputy State Dir., Bureau of Land Mgmt., to Tom Kropatsch, Supervisor, Wyo. Oil and Gas Conservation Comm'n (Aug. 9, 2024) (on file with authors) [hereinafter BLM Letter].

[228] True Oil LLC v. Bureau of Land Mgmt., 700 F. Supp. 3d 1004, 1008 (D. Wyo. 2023) (discussing argument advanced by BLM that its mineral interest, "a right inherent to their rights as a surface owner," was obstructed by proposed traversing well).

[229] *See* 40 C.F.R. § 146.23(a)(1) (2024) (establishing maximum injection pressure at wellhead permitted in zones adjacent to underground sources of drinking water for public); JONES, *supra* note 216, at 2 ("As of 2019 . . . EPA estimated that there were more than 735,000 permitted injection wells across the states and more than 6,900 additional wells on tribal lands.").

[230] The BLM has enforced trespasses for direct injections into federally managed land without proper authorization. *See, e.g.*, Citation Oil & Gas, Ltd., 21 IBIA 75, 77 (1991) (describing allegation of trespass against appellant who operated wells without prior approval of assignments or appellant's appointment as designated operator); Amoco Corp., 139 IBLA 96, 99 (1997) (discussing BLM's claim of trespass against operator who disposed water into well on public lands without previous approval of right-of-way application). It is possible that the BLM has enforced its trespass regulations in this context but that the decisions have not been appealed.

[231] *See, e.g.*, 43 C.F.R. § 2808.10(b).

around the plume to increase, at times significantly.[232] While not technically part of the sequestration area, these zones of increased pressure may be rendered unusable for additional storage. Moreover, the increase in pressure may require subsequent operations in lower formations to take additional measures to prevent containment loss. These pressure increases may therefore violate the undue degradation standard and require the Secretary to protect federal interests either by pursuing liability for trespass or by other means.[233] While migration of CO_2 into federal lands may not be undue, the accompanying loss of revenues is unnecessary.

Trespasses onto public lands for CCS could have serious consequences for the developer. In the event of a trespass, regulations authorize the BLM to assess liability for its expenses investigating and remedying the trespass, the rental for the lands, and any restoration costs.[234] This indicates that the per-unit rentals assessed for carbon sequestration could be assessed as trespass liability in the event of indirect migration into federal lands. Such an assessment could potentially be applied for both pressure increases and direct plume storage. Moreover, a trespass could prevent the user from obtaining other necessary authorizations, like a ROW or notice to proceed. BLM regulations provide that it will not process an application for use of public lands by a trespasser with outstanding liability.[235]

II. ACQUIRING RIGHTS FOR SEQUESTRATION

A. *Acquisition Procedures*

Between them, the DOD, USFS, and DOI have substantial landholdings that could be used for sequestration. Just as the purposes, authorizing statutes, and land planning processes of the departments and their administrative units differ, so do their acquisition procedures. While most agencies provide some pathway for real property acquisition, of the agencies discussed, only the BLM and USFS have directly addressed procedures for carbon sequestration authorizations. This analysis focuses on those two agencies, and to a lesser extent describes the

[232] The Class VI regulatory program models these increases as part of the area of review to assure that fluids are not pushed out of the storage formation and into underground sources of drinking water. *See* 40 C.F.R. § 261.4(h) (mandating transporters of CO_2 streams must procure certification that transportation of streams complies with safety requirements for drinking water).

[233] In the case of oil and gas drainage, the Secretary is authorized to take action to protect the federal interest from revenue losses, including entering into drainage agreements for compensatory royalties or taking administrative actions such as unitization. *See* BUREAU OF LAND MGMT., REL. NO. 3-3523, MS-3160 – DRAINAGE PROTECTION MANUAL 1-1 (2015), https://www.blm.gov/sites/blm.gov/files/uploads/mediacenter_blmpolicymanual3160.pdf [https://perma.cc/99VT-WCDA]; 30 U.S.C. § 226(j); 43 C.F.R. § 3100.2.

[234] 43 C.F.R. § 2808.11(a).

[235] *Id.* § 2808.12.

possible procedures available for wildlife reserves, tribal lands, and defense lands.

The BLM has provided the most extensive guidance regarding sequestration on federal lands. The majority of CCS project development activities on BLM lands requires a permit.[236] While there are no statutes or regulations expressly addressing use of public lands for sequestration, the BLM has issued instructional memoranda outlining its procedures. In a 2011 instructional memorandum, the BLM provided guidance for geologic storage site characterization activities.[237] While existing regulations address geophysical operations for oil and gas[238] or prospecting permits for minerals,[239] no equivalent provision exists for nonmineral subsurface exploration activities. IM 2012-35 directed project proponents to file applications for geologic storage and site characterization studies under "Section 302(b) of FLPMA and 43 CFR 2920 using Form 2920-1."[240] Following that IM's expiration, in June 2022, BLM released new guidance providing policy and direction regarding the issuance of sequestration rights in public lands.[241] Replacing the expired IM, the BLM concluded it had authority to issue ROWs for characterization, infrastructure, and sequestration in federal pore space under title V of FLPMA.[242]

Title V is the same ROW authority the BLM uses to manage roads, transmission lines, telecommunications sites, and other surface uses.[243] Almost all BLM lands are open to ROWs unless they have been statutorily excluded, withdrawn, or found inappropriate during the land planning process.[244] The use of a ROW under title V, rather than a lease under section 302, may simplify several administrative issues. First, unlike leases, ROWs do not require publication of a notice of realty action and therefore may not invite as many competitive proposals.[245] Additionally, the use of a ROW may simplify obligations regarding NEPA. The IM suggests that "[p]ublic lands open for ROWs may not require an RMP amendment, although the terms and conditions

[236] Some uses, such as short-term noncommercial activities that do not cause appreciable damage or disturbance to the public lands, may not require a permit, or could be permitted without a notice of realty actions, provided they are congruous with the BLM's land use plans, policies, and procedures. *See id.* §§ 2920.0-5(c), 2920.0-5(k), 2920.1-1(d), 2920.2-2(a).

[237] *Interim Guidance on Exploration and Site Characterization for Potential Carbon Dioxide Geologic Sequestration*, BUREAU OF LAND MGMT. (Dec. 1, 2011), https://www.blm.gov/policy/im-2012-035 [https://perma.cc/9QAQ-G37E].

[238] 43 C.F.R. § 3150.

[239] *Id*. § 3505.

[240] BLM, *supra* note 237.

[241] BLM, *Right-of-Way*, *supra* note 26.

[242] *Id.*

[243] *Id.*

[244] 43 C.F.R. § 2802.10(a) (2024).

[245] *Id.* § 2920.4.

of each RMP should be reviewed for conformance."[246] Where an RMP amendment is not necessary, the agency may be able to grant a ROW after preparing an EA, rather than doing an EIS.[247]

The BLM can issue ROWs on either a competitive or noncompetitive basis.[248] Guidance suggests that applicants should initiate the process with a preapplication meeting with the responsible agency field office to discuss the process and any specific requirements.[249] To obtain a ROW, an interested party must submit three separate documents: an application on Standard Form 299 ("SF299"), a plan of development, and a cost recovery agreement.[250] At any time prior to receipt of all three, the BLM may determine that competition exists and initiate a competitive bid process.[251]

The SF299 is the "Application for Transportation, Utility Systems, Telecommunications and Facilities on Federal Lands and Property."[252] The form itself is simple, containing only two pages and twenty questions, most of which are self-explanatory. It requires the applicant to provide basic information about itself, the proposed project and its feasibility, how the site was selected, why federal lands are needed, and expected effects on nearby populations, species, and environmental attributes including air and water quality and cultural resources.[253] The application must include preliminary site and facility plans and maps of the proposed locations.[254]

The second document, a cost-recovery agreement, assures the applicant covers the agency's costs associated with processing the application.[255] FLPMA authorizes the Secretary to establish and require the deposit of fees to cover the reasonable costs associated with applications related to use of federal lands.[256] These include: "the costs of special studies; environmental impact statements; monitoring construction, operation, maintenance, and termination of any

[246] BLM, *Right-of-Way*, *supra* note 26.

[247] Where an action did not convey any rights to use the surface for facilities, it would likely not require an EIS. *See* Connor v. Buford, 848 F.2d 1441, 1445 (9th Cir. 1988) ("[A]ppellants . . . argue that . . . leases were validly sold without the preparation of an EIS because the leases contain restrictions on surface-disturbing activities . . . . We agree with appellants . . . .").

[248] *See* 43 C.F.R. § 2804.23. *See generally id.* § 2809.

[249] *See Connor*, 848 F.2d at 1444.

[250] *See Obtaining a Right-of-Way on Public Lands*, BUREAU OF LAND MGMT. 2-3, https://www.blm.gov/sites/default/files/Lands_ROW_ObtainingaROWPamphlet.pdf [https://perma.cc/KC5V-A7PW] (last updated Mar. 10, 2018).

[251] *See* 43 C.F.R. § 2809.10(e).

[252] *Application for Transportation, Utility Systems, Telecommunications and Facilities on Federal Lands and Property*, U.S. GEN. SERVS. ADMIN., https://www.gsa.gov/system/files/2024-05/SF299-23.pdf [https://perma.cc/4HLE-UB2L] (last updated Oct. 2023).

[253] *See id.* at 1-2.

[254] *See id.* at 3.

[255] *See* 43 C.F.R. § 2804.14(a).

[256] 43 U.S.C. § 1734(b).

authorized facility; or other special activities."[257] When setting fees, the agency may consider numerous factors including the actual costs, the value of the rights sought, and any benefits to the general public interest.[258] For ROWs issued under FLPMA, processing fees for most uses are determined according to a set annual scale based on the estimated number of federal work hours involved, although in some cases when multiple ROWs are requested, the fee can be determined according to a master agreement or actual costs.[259] An applicant that disagrees with the cost category determined by the agency can appeal.[260]

The final document, a plan of development ("POD"), describes the project from construction through termination and rehabilitation.[261] While a POD is not required for every ROW granted under title V, it is always necessary where the project includes toxic substances, requires an EIS, or is for a "major project."[262] It should include design features mitigating impacts.[263] While there is not a specific outline for a plan of development for a carbon sequestration ROW, the BLM provides outlines for pipelines, dams and reservoirs, wind and solar projects, and communication sites.[264] Based on these outlines, the POD should include the a description of the purpose and need of the facilities, a description of the ROW location including maps, drawings, and legal descriptions, facility design factors, and descriptions of other components of the ROW, government agencies involved, and resource values and environmental concerns.[265] The POD should also include details regarding construction, operation and maintenance, stabilization and rehabilitation, and termination and restoration.[266] Information in the POD is used to define the "proposed action" for NEPA and other documentation.[267]

The one publicly available POD for a sequestration project, Denbury Carbon Solutions LLC's September 2023 Snowy River CO_2 Sequestration Project,

[257] *Id.* Pursuant to Office of Management and Budget ("OMB") Circular No. A-25, federal government agencies are authorized to assess a user charge when a government service provides the recipient with a special benefit, including a license for a specific public land use. *Circular No. A-25 Revised*, OFF. OF MGMT. & BUDGET (July 8, 1993), https://obamawhitehouse.archives.gov/omb/circulars_a025/ [https://perma.cc/ZWJ7-VUSF].

[258] 43 U.S.C. § 1734(b).

[259] 43 C.F.R. § 2804.14(b); *see also* Enter. Field Servs., LLC, 193 IBLA 313, 315 (2018) (describing BLM's Category 1 through 4 fee determinations and Category 5 fee determination, based upon negotiated Master Agreement).

[260] 43 C.F.R. § 2804.14(d).

[261] *Id.* § 2804.25(c).

[262] *2804 – Applying for FLPMA Grants*, BUREAU OF LAND. MGMT. § .10, https://www.blm.gov/sites/blm.gov/files/uploads/mediacenter_blmpolicymanual2804.pdf [https://perma.cc/S6AT-LSRR] (last visited Mar. 19, 2025).

[263] *Id.* at § .12C.

[264] *Id.* at illus. 2, 3, 4, 7, 8.

[265] *See, e.g.*, *id.* at illus. 2, § .10D2.

[266] *Id.*

[267] *Id.* at § .12c.

provides a helpful example.[268] Submitted in conjunction with its ROW application for surface facilities and underground pore space, the 100-page plan of development incorporates many of the aspects of a Class VI permit filing.[269] It provides detailed information on the subsurface pore space; surface facilities such as roads, well pads, pipelines, transmissions, and compressors; and the project sequence for construction.[270] In addition, it describes the project's geology and wetlands; endangered species; cultural and paleontological resources; existing land uses; and how the project's design features will mitigate damage, as well as articulating plans for spill containment and emergency responses.[271]

Once all documents are received, the ROW can be granted. By itself, however, the ROW may grant neither exclusivity in the land nor the right to commence construction or injection, even if the holder has obtained a Class VI permit. Many ROWs issued under FLPMA include a stipulation requiring a Notice to Proceed ("NTP") prior to any "ground disturbing activities."[272] NTPs are one mechanism through which the agency can ensure that project-specific mitigation measures are completed. This allows the agency to grant the ROW, subject to certain contingencies. For example, the record of decision for the TransWest Express Transmission Project specified that an applicant was to complete several required activities before issuance of an NTP and start of construction.[273] The first environmental assessment and decision record issued by the BLM for a subsurface ROW for carbon sequestration requires that the holder of a ROW obtain a notice to proceed prior to initiating injection activities.[274]

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[268] BURNS MCDONNELL, PLAN OF DEVELOPMENT: SNOWY RIVER CO2 SEQUESTRATION PROJECT (rev. 6, 2023), https://eplanning.blm.gov/public_projects/2026556/200564713/20086275/250092457/1_Snowy%20River%20CO2%20Sequestration%20Plan%20of%20Development_508.pdf [https://perma.cc/RKT7-ZRYL]. The Snowy River plan encompasses approximately 110,000 acres of pore space, more than 90% of which is federal. *Id.* at 1-1.

[269] *Id.*

[270] *Id.* at 2-1 to 2-3, 2-6, 2-9.

[271] *Id.* at 3-1, 4-15, 5-1, 5-3, 5-5, 5-7, 6-1, 7-1.

[272] 43 C.F.R. § 2805.12(a)(16), (b) (2024).

[273] U.S. DEP'T OF THE INTERIOR, BUREAU OF LAND MGMT., RECORD OF DECISION: TRANSWEST EXPRESS TRANSMISSION PROJECT AND RESOURCE MANAGEMENT PLAN AMENDMENTS, APPENDIX F: NOTICE TO PROCEED PROCESS AND MITIGATION AND MONITORING REQUIREMENTS, F-2 (2016) https://eplanning.blm.gov/public_projects/nepa/65198/92793/111802/AppF_TWE_ReqdMitigation.pdf [https://perma.cc/B8MG-VN4N].

[274] BUREAU OF LAND MGMT., DECISION RECORD: ENVIRONMENTAL ASSESSMENT DOI-BLM-WY-D090-2023-0010-EA SOUTHWEST WYOMING CO_2 SEQUESTRATION (2025), https://eplanning.blm.gov/public_projects/2023000/200543620/20130218/251030198/3%20TallgrassCO2SequestrationSWWyomingDR_final%203.26.pdf [https://perma.cc/9EWS-3S48].

IM 2022-041 suggests that an NTP would be required for sequestration projects.[275] The inclusion of a notice-to-proceed requirement is a substantial distinction between public land ROWs and private sequestration agreements. In most private agreements, the grant of the lease or easement gives the holder the full rights of use and occupancy. Once the holder receives other necessary permits, it can begin construction or injection activities without further involvement from the landowner. In contrast, with federal ROWs, even if the property was unitized and injection permits had been granted, the ROW holder could not commence operations until the agency issued an NTP. It is unclear exactly how the process would work. For instance, while it is clear that an NTP could be required before installation of surface facilities, it is unclear whether "ground disturbing activities" would also include subsurface plume migration into the ROW. If so, the terms of the ROW should specify whether an NTP would be required prior to commencing any injections—including injections on private or state lands within the project area—or would only be necessary prior to the time when the plume reached the perimeter of the ROW.

The time lag between the grant of the ROW and the issuance of an NTP raises interesting questions about the scope of rights granted at the end of the ROW process. A ROW does not convey an exclusive possessory interest in the lands covered, only the right to use the ROW for the purposes for which it was granted.[276] The noninterference obligations suggested in the IM apply only to authorized uses.[277] While regulations would require notice to other users,[278] if construction and injection operations are not "authorized" until after the notice to proceed, there is a potential for the BLM to issue overlapping ROWs, with priority determined by which party received the first NTP, rather than which was granted the first ROW.[279]

On USFS lands, the process is slightly different. FLPMA authorizes the Secretary of Agriculture to issue ROWs "with respect to lands within the National Forest System."[280] On USFS lands, sequestration would require the issuance of a special use authorization.[281] A special use authorization is a legal document such as a permit, term permit, lease, or easement, which allows occupancy, use, rights, or privileges of NFS lands, primarily for commercial use.[282] Special use authorizations are used for a wide variety of uses—ranging from recreation to ski resorts.[283] As with BLM ROWs, applicants for easements

[275] BLM, *Right-of-Way*, *supra* note 26.

[276] 43 U.S.C. § 1761.

[277] BLM, *Right-of-Way*, *supra* note 26.

[278] 43 C.F.R. § 2807.14.

[279] *See* Bloomenthal, *supra* note 149 and accompanying text; *see* BLM Letter, *supra* note 227.

[280] 43 U.S.C. § 1761(a).

[281] 36 C.F.R. § 251.53(l) (2024).

[282] *Id.* § 251.51 (defining types of special use authorizations).

[283] *Id.* § 251.53(k), (n).

or other rights in NFS lands are required to meet with the agency and then file a special use permit application on SF299.[284]

The USFS currently administers approximately 74,000 special use authorizations for various purposes on NFS lands, which include powerline and communication facilities, outfitting and guiding, campground concessions, and resorts.[285] To obtain a special use authorization for a new use or activity, a proponent must generally submit a special use proposal which meets two sets of screening criteria in USFS's existing special uses regulations.[286] If the proposal meets all the screening criteria, the proponent may submit a special use application for evaluation by the USFS.[287]

However, current USFS regulations are incompatible with geologic sequestration. Per the existing initial screening criterion at 36 C.F.R. § 251.54(e)(1)(iv), the USFS may not authorize projects that would "create an exclusive or perpetual right of use or occupancy."[288] Because the CO_2 would remain permanently within USFS lands, any application for a special use permit would be rejected based on these initial screening criteria. Accordingly, in November 2023, the USFS announced a proposed rule amendment to address this limitation.[289] Under the proposal, the USFS would provide an exemption for carbon capture and storage within its special use authorization criteria.[290] If finalized, the rule would allow forest managers to consider special use authorizations, though it would not guarantee they would be granted.[291] As indicated in the proposed rule, any proposal would still be evaluated for conformity with applicable land management plans, public safety, and noninterference with other authorized uses or adjacent lands.[292]

Other federal land management agencies have not yet directly addressed the procedures for acquiring sequestration rights, but they may have pathways within their existing regulations. For example, within the DOD, land use requests are submitted directly to the installation, with a description of the

[284] Information Collection: Special Use Administration, 88 Fed. Reg. 9856, 9856 (Feb. 15, 2023) (seeking comments on extension of "currently approved information collection, Standard Form–299"); *How Do I Apply for a Special-Use Permit*, U.S. DEP'T OF AGRIC.: FOREST SERV., https://www.fs.usda.gov/working-with-us/contracts-commercial-permits/how-to-apply-for-special-use-permit (last visited Mar. 19, 2025).

[285] Land Uses; Special Uses; Cost Recovery, Strict Liability Limit, and Insurance, 88 Fed. Reg. 14517, 14517 (proposed Mar. 9, 2023) (to be codified at 36 C.F.R. pt. 251).

[286] 36 C.F.R. § 251.54(e)(1), (5).

[287] *Id.* § 251.54(g)(1).

[288] *Id.* § 251.54(e)(1)(iv).

[289] Land Uses; Special Uses; Carbon Capture and Storage Exemption, 88 Fed. Reg. 75530, 75530 (proposed Nov. 3, 2023) (to be codified at 36 C.F.R. pt. 251).

[290] *Id.* at 75531.

[291] *Id.*

[292] *Id.*

proposed use, justification, and environmental impact.[293] For leases exceeding $100,000, the DOD requires congressional notice and competitive procedures.[294] Unlike the BLM, it is the value of the contract, rather than the number of interested parties, that triggers a competitive process. In contrast, within wildlife refuges, no specific application form is required.[295] Trust lands administered by the BIA require a premeeting between the BIA, applicant, and tribe or landowners, followed by prescribed consent and application procedures in accordance with BIA regulations.[296] As sequestration projects become more prevalent and implicate these lands, agencies may need to clarify their processes.

B. *The Problem of Rent*

Whether public, military, or private, all statutes authorizing grants of private interests in public land require an exchange of fair market value rents. This requirement has its origins in the common law public land trust.[297] While sparsely developed, early judicial precedent implied that both Congress and land agencies had a "high public duty" when disposing of land "held in trust for all the people."[298] Courts have held that Congress can dispose of public land below its fair market value, but executive agencies cannot.[299] When public resources are underpriced, it encourages economic and physical waste through lost revenue and overuse, and it creates inequity "between those citizens who are

[293] U.S. GOV'T ACCOUNTABILITY OFF., GAO-08-850, DEFENSE INFRASTRUCTURE: SERVICES' USE OF LAND USE PLANNING AUTHORITIES 5 (2008), https://www.gao.gov/assets/gao-08-850.pdf [https://perma.cc/48PB-PB4D].

[294] 10 U.S.C. § 2667(h) requires competitive procedures for leases longer than one year or valued at more than $100,000, though no equivalent procedure is required for granting easements.

[295] 50 C.F.R. § 29.21-2(a)(1) (2024).

[296] 25 C.F.R. §§ 169.106-.107 (2024). In 2022, the BIA issued a National Policy Memorandum for carbon sequestration agreements; however, it refers only to nature-based solutions like soil and forestry carbon removals. It was amended first in 2023 and then again in 2024, and it is currently set to expire in October 2025. *See* U.S. DEP'T OF THE INTERIOR, U.S. BUREAU OF INDIAN AFFS., NPM-TRUS-47 A2, Carbon Sequestration Agreement Policy – Amendment 2, at 1 (2024), https://www.bia.gov/sites/default/files/dup/assets/public/raca/national_policy_memoranda/pdf/npm-trus-47_a2_carbon-sequestration-policy-a2_final_signed_508.pdf [https://perma.cc/PMS9-XUXJ].

[297] Michigan Law Review, *Proprietary Duties of the Federal Government Under the Public Land Trust*, 75 MICH. L. REV. 586, 590 (1977).

[298] United States v. Trinidad Coal & Coking Co., 137 U.S. 160, 170 (1890).

[299] *Id.*; Joseph L. Sax, *The Public Trust Doctrine in Natural Resource Law: Effective Judicial Intervention*, 68 MICH. L. REV. 471, 503-04, 508 (1970). In some contexts, the BLM has disposed of public land at less than its appraised fair market value "generally to resolve trespasses that posed difficult management situations." *See* U.S. GEN. ACCT. OFF., GAO-01-882, BLM AND THE FOREST SERVICE: FEDERAL TAXPAYERS COULD BENEFIT MORE FROM LAND SALES 3 (2001), https://www.gao.gov/assets/gao-01-882.pdf [https://perma.cc/SNB8-TDYA].

subsidized and those who are not."[300] Where the government acquires or disposes of land, courts have found that its trust obligations create a duty to secure the land's full value.[301] As the following Section will show, these judicial requirements have since been codified in statute and in regulations.

1. Fair Market Value

FLPMA establishes backbone principles for valuation of interests in public lands and resources. Unless otherwise provided for by statute, it requires that the United States receives fair market value for the use of public lands and resources.[302] It further provides that public lands should be disposed of in a manner that is "consistent with the prescribed mission of the department or agency involved."[303] This requirement is reiterated throughout sections relating to the use and disposition of public lands, including sales of public land tracts,[304] conveyances to states and local governments,[305] conveyances of mineral interests to the record surface owner,[306] and grants of ROWs.[307]

BLM regulations under FLPMA provide that a ROW holder will pay a BLM-established rent "based on sound business management principles and, as far as practical and feasible, using comparable commercial practices."[308] This provides the agency with considerable discretion. The structure of rent can vary based on the type of resource and rights granted.[309] Rents also differ based on whether the ROW is linear or areal, and can be paid either annually or as a percentage of production.[310] Unless a ROW grant is covered by a provided-for payment schedule, the BLM determines the value for rental payments "through a process based on comparable commercial practices, appraisals, competitive bids, or other reasonable methods."[311]

[300] Michigan Law Review, *supra* note 297, at 604.

[301] *See, e.g.*, Navajo Tribe of Indians v. United States, 364 F.2d 320, 342 (Ct. Cl. 1966) (recognizing government's "highly pertinent" fiduciary duty of accurate valuation as trustee for Navajo Tribe); United States v. 111.2 Acres of Land, 293 F. Supp. 1042, 1050 (E.D. Wash. 1968) (requiring United States to pay full market value of easement taken by eminent domain).

[302] 43 U.S.C. § 1701(a)(9).

[303] *Id.* § 1701(a)(10).

[304] *Id.* § 1713.

[305] *Id.* § 1721.

[306] *Id.* § 1719.

[307] *Id.* § 1764.

[308] 43 C.F.R. § 2806.10 (2024).

[309] *See id.*

[310] *See generally 2806 – Rent*, BUREAU OF LAND MGMT., https://www.blm.gov/sites/default/files/docs/2022-05/MS-2806%20rel%202-307.pdf [https://perma.cc/SU9H-ZATY] (last visited Mar. 19, 2025).

[311] 43 C.F.R. § 2806.70.

Fair market value principles are also incorporated into USFS rules. Valuations for special use authorizations are determined according to the provisions of 36 C.F.R. § 251.57 and 36 C.F.R. § 251.58.[312] As with BLM ROW regulations, special use authorizations must cover administrative costs and include an annual land use fee.[313] These rental fees "shall be based on the fair market value of the rights and privileges authorized."[314] USFS Manual 2700, which generally provides guidance on the calculation of fees for specific uses, suggests that fair market value should be determined by appraisal or other sound business management principles.[315]

The DOD similarly requires fair market value. The Office of the Under Secretary of Defense (Comptroller) maintains DOD Financial Management Regulations regarding the "disposal, transfer, and leasing of real property, and the transfer and lease of personal property."[316] These regulations authorize the Secretary to lease nonexcess property at "not less than the fair market value" and to use the funds received to cover administrative expenses.[317] DOD also relies on appraisal to determine value. For example, when leasing to banking institutions on military installations, both land leases and leases of improvements must "be at the appraised fair market rental value."[318] Uniquely, for defense leases and easements, the Secretary may elect to receive payment either in cash or in kind.[319] Consideration, whether in cash or in kind, must benefit any property or facilities under the control of the Secretary.[320] However, if the Secretary elects to receive cash, at least half must be made available for use at the installation where the proceeds came from.[321] Appropriate forms of in-kind services could include improvements or repairs, construction of new facilities, provision or payment of utility services that support resiliency, or other services related to activities on the lease property.[322] For example, when the Army leased land to Hawaiian Electric for a fifty-megawatt alternating current

[312] 36 C.F.R. §§ 251.57-.58 (2024).

[313] *Id.*

[314] *Id.* § 251.57(a)(1).

[315] U.S. FOREST SERV., AMENDMENT NO. 2700-022-2, FSM 2700 -– SPECIAL USES MANAGEMENT § 2715.03 (2022).

[316] 12 DEP'T OF DEF., DOD 7000.14-R, FINANCIAL MANAGEMENT REGULATION ch. 14, § 1.1 (2022), https://comptroller.defense.gov/Portals/45/documents/fmr/Combined_Volume1-16.pdf.

[317] *Id.* §§ 2.1-2.2.

[318] *Id.* at ch. 33, § 4.6.

[319] 10 U.S.C. § 2667(b)(4).

[320] *Id.* § 2667(c), (e).

[321] *Id.* § 2667(e)(1)(D).

[322] *Id.* § 2667(c).

rate-based multifuel plant, it received in exchange the first right to power from the plant during a grid outage.[323]

The fair market value requirement is nearly ubiquitous where the government is exercising its trust duty with respect to public lands.[324] The USFS appraises timber[325] and special use authorizations[326] at fair market value, while NPS leases and freeholds must be "at the highest bid price, but not less than fair market value,"[327] and USFWS regulations require payment for use and occupancy at fair market value, as determined by the Regional Director.[328] While grants in tribal lands are often negotiated with the tribe, regulations allow the tribe to request a fair market value assessment, whereas grants of ROWs over individually owned Indian lands *must* have compensation of not less than fair market value.[329] These valuations are determined by the Appraisal and Valuation Services Office ("AVSO") based on "market analysis, appraisal, or other appropriate valuation method" in accordance with the Uniform Standards of Professional Appraisal Practice.[330]

2. The Appraisal Process

Appraisals are the primary method of determining fair market value for federal lands. The AVSO is an office within the DOI responsible for setting valuation and appraisal policies and conducting appraisals for land acquisitions,

[323] *Public Meeting: Schofield Generating Station Project Draft Environmental Impact Statement*, U.S. ARMY (May 21, 2015), https://home.army.mil/hawaii/application/files/7415/5977/4867/CommentMeeting_Posters.pdf [https://perma.cc/WR5G-VGZF].

[324] In rare cases, Congress has authorized agencies to accept less than fair market value. For example, the Secretary of the Army may accept less than fair market value, and then only where it serves a public interest and fair market value is unobtainable or incompatible with the public benefit. 10 U.S.C. § 2667(g)(2). Moreover, the Department of Energy may, under certain conditions, sell or lease defense nuclear facilities for economic development at less than fair market value. 10 C.F.R. § 770.8 (2024). Unlike the military leasing authority, the Secretary is not required to receive consideration for easements, but if consideration is sought, it follows the same rules as a § 2667 lease. 10 U.S.C. § 2668(a), (e).

[325] 36 C.F.R. § 223.60 (2024).

> Valid methods to determine fair market value include, but are not limited to, transaction evidence appraisals, analytical appraisals, comparison appraisals, and independent estimates based on average investments. Pertinent factors affecting market value also considered include, but are not limited to, prices paid and valuations established for comparable timber, selling value of products produced, estimated operating costs, operating difficulties, and quality of timber.

Id.

[326] *Id.* § 251.57.

[327] *Id.* § 17.8.

[328] 50 C.F.R. § 29.21-7 (2024).

[329] 25 C.F.R. §§ 169.110, 169.112 (2024).

[330] *Id.* § 169.114; 25 U.S.C. § 2214; U.S. DEP'T OF THE INTERIOR, 601 DM 1, DEPARTMENT MANUAL § 1.4 (2021), https://www.doi.gov/document-library/departmental-manual/601-dm-1-jurisdiction [https://perma.cc/UL6P-HZAE].

exchanges, and dispositions, including of minerals, on federal and tribal trust lands.[331] While appraisal services were previously housed within bureau offices, in 2003, following recommendations of the Land Transaction Working Group, the Secretary of the Interior consolidated appraisal functions in the Appraisal Services Directorate ("ASD") within the National Business Center ("NBC").[332] However, this initial arrangement was problematic. In its 2006 report, the Government Accountability Office found that appraisal services were inhibited due to lack of support from the NBC.[333] In 2009, Congress expressed concern about delays and the adequacy of appraisals,[334] ultimately leading to the DOI's conclusion that the agency required greater organizational independence.[335] The ASD was reorganized in 2010 as the Office of Valuation Services in the Office of Policy, Management, and Budget, and then consolidated in 2018 as the AVSO.[336] As of 2023, it had fourteen offices divided into three regions across the United States.[337]

FLPMA, like many other land management statutes, requires that appraisals "reflect nationally recognized appraisal standards, including, to the extent appropriate, the Uniform Appraisal Standards for Federal Land Acquisitions" ("UAS"), also called the Yellow Book.[338] Notwithstanding that the UAS pertains to federal acquisition of lands, not to grants of ROWs, the UAS establishes several guiding principles for valuation decisions.[339] These standards are "developed, revised, approved, adopted and promulgated on behalf of the Interagency Land Acquisition Conference."[340] Established in 1968, the

[331] U.S. DEP'T OF THE INTERIOR, ORDER NO. 3363, CONSOLIDATION OF THE OFFICE OF APPRAISAL SERVICES AND THE OFFICE OF VALUATION SERVICES INTO THE APPRAISAL AND VALUATION SERVICES OFFICE § 1 (2018).

[332] U.S. DEP'T OF THE INTERIOR, REPORT NO. WR-EV-OSS-0012-2009, EVALUATION REPORT ON THE DEPARTMENT OF THE INTERIOR'S APPRAISAL OPERATIONS 4 (2009), https://www.doioig.gov/sites/default/files/2021-migration/WR-EV-OSS-0012-2009.pdf [https://perma.cc/8N62-4U25].

[333] *See* U.S. GOV'T ACCOUNTABILITY OFF., GAO-06-1050, INTERIOR'S LAND APPRAISAL SERVICES: ACTIONS NEEDED TO IMPROVE COMPLIANCE WITH APPRAISAL STANDARDS, INCREASE EFFICIENCY, AND BROADEN OVERSIGHT 31 (2006), https://www.gao.gov/assets/gao-06-1050.pdf [https://perma.cc/S2F5-KA6U].

[334] H.R. REP. NO. 111-316, at 78 (2009) (Conf. Rep.).

[335] U.S. DEP'T OF THE INTERIOR, *supra* note 332, at 3, 10.

[336] *About Us*, U.S. DEP'T OF THE INTERIOR, https://www.doi.gov/valuationservices/about-us [https://perma.cc/WSN7-NAK6] (last visited Mar. 19, 2025).

[337] *AVSO Info Sheets Q1 FY23*, U.S. DEP'T OF THE INTERIOR (Jan. 24, 2023), https://www.doi.gov/sites/doi.gov/files/avso-flysheets-q1-fy23.pdf [https://perma.cc/H34L-ZAC5].

[338] *See* 43 U.S.C. § 1716(f)(2).

[339] INTERAGENCY LAND ACQUISITION CONF., UNIFORM APPRAISAL STANDARDS FOR FEDERAL LAND ACQUISITIONS 25-36 (2016).

[340] *Id.* at frontmatter.

Conference is a voluntary organization "composed of the many Federal agencies engaged in the acquisition of real estate for public uses."[341]

The Yellow Book instructs that land appraisals should reflect the market value of the land's highest and best use.[342] Highest and best use is understood to be the "most profitable use for which the property is adaptable and needed or likely to be needed in the reasonably near future."[343] Noneconomic uses are typically not considered in the calculation of fair market value.[344] In reaching a conclusion of highest and best use, the appraiser must identify the most profitable buyer or user for that use.[345] The appraiser must then consider the value of the land. To do so, the UAS suggest three possible methodologies: sales comparison, income capitalization, and the cost approach.[346] Like the IM, the appraisal guide suggests using comparable sales based on the appropriate unit of comparison, taking into consideration variables such as "location (relative to market demand, processing facilities, transportation options, etc.), certainty (e.g., proven or unproven deposits), mineral content or type, mineral quality, mineral quantity, and zoning or permitting status."[347]

Grantees who disagree with the value of the appraisal can appeal.[348] For the BLM, appeals of agency decisions fall within the purview of the IBLA.[349] The IBLA will set aside the appraisal only if the grantee can show an error in the appraisal method, can show that the charges are excessive, or can rebut it with another appraisal.[350] In *Mallon Oil Co.*,[351] the grantee of a ROW for produced water disposal appealed the BLM's appraisal of a facility fee and injection fee of $0.05 per barrel.[352] Mallon argued the BLM was wrong to consider commercial agreements as comparable transactions and that in considering only the fair market rental value of the ROW, the BLM failed to weigh other nonproprietary concerns like the need for domestic oil and gas production.[353]

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[341] 41 C.F.R. § 102-73.280 (2024).

[342] INTERAGENCY LAND ACQUISITION CONF., *supra* note 339, at 22.

[343] Olson v. United States, 292 U.S. 246, 255 (1934).

[344] Financial Assistance Interior Regulation, 84 Fed. Reg. 45627, 45632 (Aug. 30, 2019) (codified at 2 C.F.R. pt. 1402).

[345] *See* INTERAGENCY LAND ACQUISITION CONF., *supra* note 339, at 22.

[346] *Id.* at 25.

[347] *Id.* at 181 (citing United States v. 100.80 Acres of Land, 657 F. Supp. 269, 276 n.13 (M.D.N.C. 1987); United States v. Am. Pumice Co., 404 F.2d 336, 336-37 (9th Cir. 1968); Foster v. United States, 2 Cl. Ct. 426, 448-55 (1983); United States v. 33.92356 Acres, 585 F.3d 1, 8-9 (1st Cir. 2009)).

[348] 43 C.F.R. § 2806.70 (2024).

[349] 43 C.F.R. § 2801.10; Mallon Oil Co., 104 IBLA 145, 146 (1988).

[350] *Mallon Oil Co*., 104 IBLA at 150-51.

[351] *Id.* at 145.

[352] *Id.* at 148.

[353] *Id.*

The IBLA disagreed, affirming the BLM's appraisal.[354] *Mallon* is significant because it confirms two points: that the BLM can look at private commercial agreements in determining fair market value, and that nonproprietary considerations regarding the use of public lands are not a factor in appraisal.

3. Rental Schedules

For some ROWs, the agency will rely on a rental schedule, rather than appraisal. A rental schedule can minimize the need for individual appraisals and thereby avoid "the costs, delays, and unpredictability of the appraisal process."[355] The BLM has rental schedules for linear ROWs and communication uses, among others.[356] Rental schedules are developed through rulemaking and incorporated into the regulations. As a result, they are subject to the Administrative Procedure Act ("APA"), thus providing opportunities for public input and judicial review of agency methods. At times, Congress may direct the agency to update rentals to achieve other policy objectives.[357]

Rental schedules must reflect the fair market value.[358] As a result, rental schedules are often customized based on geographic location or localized land values.[359] The update of the Linear ROW Rent Schedule in 2007 provides an excellent example.[360] The original 1987 rule set forth a schedule including eight "zones" based on state, county, and type of ROW.[361] When crafting the zones, the BLM relied on mapping, and evaluation of "the average per acre land value for each county was based upon a review of the typical per acre value for the types of lands that the BLM and the FS had allocated to various utility and right-of-way facilities."[362] When the rule was later updated, the agency requested and incorporated information from the public regarding which published sources of

[354] *Id.* at 152.

[355] Update of Linear Right-of-Way Rent Schedule, 73 Fed. Reg. 65040, 65040 (Oct. 31, 2008) (codified at 43 C.F.R. pts. 2800, 2880, 2920).

> We believe it is sound business management to determine rent through a system of rent schedules. Using rent schedules eliminates the need to prepare an individual appraisal report for each of the estimated 3,500 grants and leases BLM issues each year. It is not feasible or cost effective to prepare, review, and approve individual appraisal reports for each right-of-way because of the time and expense required to prepare and review appraisal reports.

Rights-of-Way, Principles and Procedures; Rights-of-Way Under the Federal Land Policy and Management Act and the Mineral Leasing Act, 70 Fed. Reg. 20970, 21004 (Apr. 22, 2005) (codified at 43 C.F.R. pts. 2800, 2810, 2880, 2920, 9230, 9260).

[356] 43 C.F.R. §§ 2885.19, 2885.23 (2024).

[357] 43 U.S.C § 3003.

[358] Rights-of-Way, Principles and Procedures; Rights-of-Way Under the Federal Land Policy and Management Act and the Mineral Leasing Act, 70 Fed. Reg. at 21004.

[359] *See* 43 C.F.R. § 2885.19(a).

[360] *See* Update of Linear Right-of-Way Rent Schedule, 73 Fed. Reg. at 65041.

[361] *Id.* at 65043.

[362] *Id.*

data to use and whether specific data sources were appropriate.[363] It specifically requested feedback on use of data from the National Agricultural Statistics Service ("NASS").[364] By both customizing the rental schedule geographically and indexing it to data that is updated, the BLM can annually adjust the updated schedule to account for changing market conditions.[365] New rental schedules are communicated through instructional memoranda and incorporated into BLM and USFS Manuals.[366]

4. Reassessments of Rent

Importantly, public land rentals for ROWs are rarely static. Rentals may fluctuate either based on scheduled adjustments in published rental schedules,[367] or, where based on an appraisal, by reassessment.[368] Because ROW rentals require payment in advance of use, rentals may be estimated and reassessed.[369] During reassessment, the agency provides the ROW or easement holder with notice of the reassessment that will apply the following year.[370] Any dispute can be appealed to the appropriate reviewing board.[371]

III. VALORIZING FEDERAL PORE SPACE

Though IM 2022-041 provides basic guidance regarding the process for establishing fair market value rentals for sequestration ROWs, there is no specific guidance relating to valuation of federal pore space.[372] To the minimal extent the IM does address the issue, it separates the issue into two components: ROWs for characterization studies, surface facilities, and infrastructure; and ROWs for use and occupancy of the pore space.[373] The former is straightforward, given that ROWs for characterization studies, surface facilities, and infrastructure are already well-established uses in relation to other types of energy development. For these uses, the IM suggests that rents should be established as an annualized rental based on "appraised values or approved schedules."[374] The referenced values or schedules could include the linear ROW

[363] *Id.*

[364] *Id.*

[365] *Id.* at 65057.

[366] *Calendar Year 2016 - 2025 Linear Right-of-Way Rental Schedule*, BUREAU OF LAND MGMT. (Oct. 16, 2015), https://www.blm.gov/policy/im-2016-008 [https://perma.cc/M5CS-RR2C].

[367] 43 C.F.R. § 2806.22 (2024).

[368] *Id.* at 2806.10.

[369] *Id.*

[370] 50 C.F.R. § 29.21-7 (2024).

[371] *See, e.g.*, 43 C.F.R. § 4.700; 50 C.F.R. § 29.22.

[372] *See* BLM, *Right-of-Way*, *supra* note 26 (lacking such specific guidance).

[373] *Id.*

[374] *See id.*

schedules for items like pipelines or small site schedules for well sites or compressor facilities.[375]

Valuing the storage right in the subsurface is much more difficult. The IM provides only that rentals for "injecting actual amounts of CO2 for sequestration into Federal pore space and use and occupancy of the pore space" shall be assessed on a "per unit basis"[376] and determined in consultation with the AVSO.[377] Yet, the IM does not define "per unit basis."[378] The term could accordingly refer to the tons of CO_2 injected as well as the number of acres or to acre feet of subsurface property interests that will be occupied by the CO_2 or encumbered by the ROW. Though it is possible that some empirical valuation standards could be gleaned from private pore space leases, there is very little precedent in terms of either publicly available comparable sales or established rents. As of the time of this writing, a few state land offices have entered into agreements with project developers, including in California, Texas, Colorado, Louisiana, Mississippi, and Wyoming.[379] While there is an increasing number of private party agreements, usually only a memorandum of agreement is recorded, and thus key terms are not available.

This Section considers per-unit rental approaches used to value other federal resources, which may serve as instructive analogues in devising a consistent valuation system for federal pore space. It begins with a review of grants of interests that include either injection into or withdrawal from federal pore space: oil and gas production, produced water disposal, and natural gas storage. These are subject to similar uncertainties regarding their extent and, like sequestration, do not necessarily require use or exhaustion of federal surface resources. The second category of ROWs is those granted for development of renewable energy resources, namely solar and wind. While these uses do not include subsurface use, they do include a per-unit rental and demonstrate important principles of rental setting related to the concept of encumbrance. Examined across resources, these approaches to valuation illustrate core principles that could be applied to compensation structures in pore space ROWs. While the analysis in this Section is limited to uses of BLM lands, the conclusions have applicability across land management agencies.

[375] *See id.*

[376] *Id.*

[377] *Id.*

[378] *See id.*

[379] *See* Madeleine J. Lewis & Tara K. Righetti, *Contracting the Void: Land, Capital, and Sequestration*, COLUM. J. ENV'T L. (forthcoming 2025).

A. *Subsurface Uses of Federal Pore Space and Associated Compensation Structures*

1. Oil- and Gas-Related Use of Pore Space

Much of the federal subsurface is currently encumbered by existing federal oil and gas leases. Pursuant to the MLA[380] and the Mineral Leasing Act for Acquired Lands ("MLAAL"),[381] the BLM administers the grant of rights for oil and gas development.[382] Prior to enactment of the MLA, oil and gas rights were patented under an 1897 mining law.[383] Under the 1897 law, once the claim was patented, the patentee took title and owed no payment to the government.[384] When it became apparent that the United States was rapidly losing control of a valuable and strategic resource, President William Howard Taft withdrew several areas of known oil lands from entry.[385] After considerable protest by oil producers[386] and western states[387] and vigorous debate among lawmakers, they reached a compromise: Congress would create a leasing system by which private rights of development could be granted in exchange for the payment of royalty.[388] This system included three forms of compensation under the oil and gas lease: royalty, rental, and bonus.

a. *Royalty*

Oil and gas royalties compensate for the value of the oil and gas removed from the leased premises. The federal landowner receives a cost-free share of the value of production.[389] The method of calculation is established by federal

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[380] 30 U.S.C. § 201.

[381] *Id.* §§ 351-360.

[382] Pursuant to a grant of authority under the FOOGLRA, the BLM administers oil and gas development on both NFS and other public lands. *See id.* § 226.

[383] United States v. Midwest Oil Co., 236 U.S. 459, 466-67 (1915).

[384] *Id.*

[385] *Id.*

[386] Wm. E. Colby, *The New Public Land Policy with Special Reference to Oil Lands*, 3 CALIF. L. REV. 269, 285 (1915).

[387] J. Leonard Bates, *The Midwest Decision, 1915: A Landmark in Conservation History*, 51 PAC. NW. Q 26, 26 (1960); Laura Lindley & Robert C. Mathes, *Formal and De Facto Federal Land Withdrawals and Their Impacts on Oil and Gas and Mining Developments in the Western States*, *in* PROCEEDINGS OF THE ROCKY MOUNTAIN MINERAL LAW FORTY-EIGHTH ANNUAL INSTITUTE § 25.01 (2002).

[388] Mineral Leasing Act of 1920, ch. 85, 41 Stat. 437 (codified as amended in scattered sections of 30 U.S.C. §§ 181-226).

[389] Sarah L. Inderbitzen, *This Little Company Went to Market:* IPAA v. Dewitt *and the Duty to Market Federal Oil and Gas Production at No Cost to the Lessor*, 54 ADMIN. L. REV. 1167, 1168 (2002).

regulation.[390] These regulations require payment of a fractional share of the *volume* of oil or gas produced multiplied by the *value of the product* when placed into the market.[391] While the federal lessee alone bears the risk of placing the substance into marketable condition and marketing, the government and the lessee share in the market risk related to oil and gas prices. The federal lessor and the lessee share risk related to both the extent of the resource and its value at the time of production. 80% of federal oil and gas revenue comes in the form of royalties.[392]

Oil and gas royalties were initially set by Congress with the MLA.[393] For nearly 100 years the royalty rate on federal lands was 12.5%.[394] It was not until Congress passed the IRA in 2022 that royalties were increased, with Section 50262 of the IRA elevating the amount to 16.66% and 20% for certain reinstated leases.[395] Unlike private oil and gas leases, the royalty rate for federal leases is the same throughout the country and does not vary regionally with the value of the resource.[396] The federal share is constant,[397] but because the payment is based on volume, the total amount of royalty will be greater the better the resource. Whereas in private leases the royalty rate is negotiated and fluctuates, the royalty in federal leases is static, with the differential between private and public royalty rates captured through bonus bidding (discussed below).

b. *Rentals*

Federal oil and gas leases also require rentals for each year in which development is deferred and in which the federal government is thus not receiving royalty payments. Rentals are typically small in comparison to bonus and royalty payments,[398] and serve only as consideration for the right to defer development within the primary term.[399] Rental payments also replace the

[390] 30 C.F.R. §§ 1202-1206 (2024). Because this authority limited to administration of minerals covered by the Mineral Leasing Act, it does not include grants of pore space for purposes unrelated to mineral development.

[391] *Id.* § 1206.101; Jayni Foley Hein, *Federal Lands and Fossil Fuels: Maximizing Social Welfare in Federal Energy Leasing*, 42 HARV. ENV'T L. REV. 1, 15 (2018).

[392] Hein, *supra* note 391, at 15.

[393] *See* Mineral Leasing Act; 30 U.S.C. § 226(b)(1)(A).

[394] *See* Inflation Reduction Act of 2022, Pub. L. No. 117-169, § 50262, 136 Stat. 1818, 2056 (codified at 30 U.S.C. § 226).

[395] *Id.*; 30 U.S.C. § 226(b)(1)(A).

[396] *See* 30 U.S.C. § 226(b)(1)(A) (setting rate for all federal leases).

[397] In some cases, to encourage development, the Secretary has authority to lower the royalty rate. *See id.* § 209.

[398] Michael J. Boskin, Marc S. Robinson, Terrance O'Reilly & Praveen Kumar, *New Estimates of the Value of Federal Mineral Rights and Land*, 75 AM. ECON. REV. 923, 925 n.8 (1985).

[399] PATRICK H. MARTIN & BRUCE M. KRAMER, WILLIAMS & MEYERS, OIL AND GAS LAW ABRIDGED EIGHTH EDITION §§ 601.5, 605 (2020).

implied obligation to drill an exploratory well.[400] For federal leases, Congress has uniformly set delay rental amounts without regard to the amount of the bonus payment. With passage of the IRA, Congress modified fossil fuel rentals from $1.50 per acre to a graduated structure of $3.00 per acre for the first two years, $5.00 per acre for years three through eight, and $15.00 per acre thereafter.[401] Rentals are higher for reinstated leases, increasing progressively with each subsequent reinstatement.[402] Following commencement of production, the rental converts to a minimum royalty.[403]

c. *Bonus*

In addition to royalties and rentals, oil and gas operators on federal lands also must pay a lease bonus at the time of the grant of the lease. The bonus is consideration for the "bundle of rights obtained by the lessee from the lessor under an oil and gas lease. . . . It is, in short, not a royalty at all but rather the selling price of the lease."[404] Commonly referred to as a "signing bonus," the bonus both provides a way for bidders to differentiate themselves and provides the lessor with a "speculative inducement to enter the lease insofar as the lessee will be able to collect additional royalties if production occurs on the property."[405] "Bonuses are cash payments that are not conditional on the existence or size of the resource, and are typically the variable subject to bidding."[406]

The process for determining bonus amounts for onshore oil and gas leases has changed substantially since passage of the MLA in 1920. Prior to 1987, the process consisted of a bifurcated system wherein lands within designated "Known Geologic Structures" were leased competitively, while other lands, which were subject to considerably more uncertainty, were leased noncompetitively.[407] This process assumed that there was no competitive demand for areas without known deposits. Following heavy criticism, in 1987

[400] Ross L. Malone, *Problems Created by Express Lease Clauses Affecting Implied Covenants*, *in* PROCEEDINGS OF THE ROCKY MOUNTAIN MINERAL LAW SECOND ANNUAL INSTITUTE ch. 7 (1956); Sundheim v. Reef Oil Corp., 806 P.2d 503, 509-10 (Mont. 1991).

[401] Inflation Reduction Act of 2022, Pub. L. No. 117-169, § 50262, 136 Stat. 1818, 2056 (codified at 30 U.S.C. § 226); *see* Fluid Mineral Leases and Leasing Process, 89 Fed. Reg. 30916, 30974 (Apr. 23, 2024) (to be codified at 43 C.F.R. §§ 3100-3180).

[402] 43 C.F.R. § 3103.22(c)-(d) (2024).

[403] *Id.* § 3103.22(b).

[404] Vester T. Hughes, Jr., *Restoration of Depletion on Bonus Payments by a Landowner Under an Oil and Gas Lease*, 39 TEX. L. REV. 271, 273 (1961).

[405] Zachary R. Eiken, Note, *The Dark Side of the Bakken Boom: Protecting the Importance of an Oil and Gas Lease's Bonus Payment Through Proposed Legislative Amelioration of* Irish Oil and Gas, Incorporated v. Riemer, 89 N.D. L. REV. 679, 684 (2013).

[406] Boskin et al., *supra* note 398, at 925.

[407] EMMET A. FINLEY, DEP'T OF THE INTERIOR, GEOLOGICAL SURV. CIRCULAR 419, THE DEFINITION OF KNOWN GEOLOGIC STRUCTURES OF PRODUCING OIL AND GAS FIELDS 5 (1959).

Congress passed FOOGLRA.[408] FOOGLRA required that all leases first be offered for competitive bid and that only unsold leases could be leased on a noncompetitive basis at the minimum bid for two years following the competitive lease sale.[409] FOOGLRA set the minimum noncompetitive bid at $2.00 per acre and further granted the Secretary authority to increase the minimum after 1989.[410] This change required the BLM to discover whether there was a market through the competitive bid process before offering public lands for the minimum bid. In 2021, however, Congress eliminated noncompetitive leasing and substantially revised the processes for oil and gas leasing, requiring a $5.00 acre nomination fee and increasing the amount of the minimum bid, this time to $10.00 per acre.[411] While a party can still obtain a lease by offering the minimum bid at auction, if the leases are not sold, they must be renominated.

The process for offshore oil and gas leases differs substantially. Offshore energy production is managed by the Bureau of Ocean Energy Management ("BOEM") pursuant to the Outer Continental Shelf Lands Act ("OCSLA").[412] It also uses a competitive bid process. Based on the schedule of leases set forth in the five-year OCS Oil and Gas Leasing Program,[413] BOEM solicits nominations of leasing areas or interest in specific blocks.[414] Information submitted in response to the call for nominations can be maintained confidential.[415] Based on these nominations, BOEM will prepare a recommendation of the area for proposed leasing and environmental analysis, which is announced in the Federal Register.[416] After environmental reviews, if BOEM proceeds, it publishes notices of sale which include details related to the sale and information on the area for leasing, lease terms and conditions, and proposed environmental stipulations.[417] Interested parties can also access data, including pipeline, production, and well information, through the BOEM Data Center to aid in their

[408] Federal Onshore Oil and Gas Leasing Reform Act of 1987, Pub. L. No. 100-203, § 5102, 101 Stat. 1330, 1330-256 to -258 (codified as amended at 30 U.S.C. § 226).

[409] *Id.*; 30 U.S.C. § 226(b)(1)(A).

[410] Federal Onshore Oil and Gas Leasing Reform Act of 1987 § 5102. This bid was standard for all noncompetitively leased federal minerals nationwide.

[411] *See* 30 U.S.C. § 226(d).

[412] 43 U.S.C. §§ 1331-1356.

[413] BUREAU OF OCEAN ENERGY MGMT., 2024-2029 NATIONAL OUTER CONTINENTAL SHELF OIL AND GAS LEASING PROPOSED FINAL PROGRAM 3 (2023), https://www.boem.gov/sites/default/files/documents/oil-gas-energy/leasing/2024-2029_NationalOCSProgram_PFP_Sept_2023.pdf [https://perma.cc/EF8F-2YM5].

[414] *See, e.g.*, Call for Information and Nominations for Western, Central, and Eastern Gulf of Mexico Outer Continental Shelf Oil and Gas Lease Sales for 2024-2029, 88 Fed. Reg. 67801 (Oct. 2, 2023).

[415] 43 U.S.C. § 1344(g).

[416] 30 C.F.R. § 556.302(a)(3) (2024).

[417] *Id.* § 556.304(a).

evaluation of the offered lease blocks.[418] Interested parties then submit a sealed bid for each tract or bidding unit in which they are interested.[419] The bidding system includes both a cash bonus and royalty rate. BOEM will fix one of these variables and invite bids on the other.[420] BOEM then evaluates bids for adequacy, conducting an initial review of bids for legal sufficiency and anomalies as an assessment of tract viability.[421] For any tracts determined nonviable, the regional director may accept the highest qualified bid.[422] For viable tracts, the bids are subjected to a "full scale resource and economic evaluation to determine if each tract's highest qualified bid is representative of fair market value."[423]

Whether deemed viable or nonviable, the amount of the bonus is determined by auction on a competitive basis, with the primary difference being that offshore leases are offered through a sealed bid.[424] A sealed bid process may result in higher bids because no one bidder knows what another is offering, creating potential for a winner's curse—i.e., a situation in which "the winning bidder is [led] to that position because he has most over-estimated the item's true value."[425] However, the sealed bidding process—and the desire to avoid the winner's curse—also creates the possibility of unreasonably low bids. Accordingly, BOEM's bid adequacy review process functions to assure that the

[418] Call for Information and Nominations for Western, Central, and Eastern Gulf of Mexico Outer Continental Shelf Oil and Gas Lease Sales for 2024-2029, 88 Fed. Reg. at 67803; *see also Maps and GIS Data*, BUREAU OF OCEAN ENERGY MGMT., https://www.boem.gov/oil-gas-energy/mapping-and-data [https://perma.cc/6C9Y-VKLP] (last visited Mar. 19, 2025).

[419] 30 C.F.R. § 560.500.

[420] *Id.* § 560.202. *See generally* Walter J. Mead, Asbjorn Moesidjord & Philip E. Sorenson, *Competition in Outer Shelf Oil and Gas Lease Auctions: A Statistical Analysis of Winning Bids*, 26 NAT. RES. J. 95 (1986).

[421] A "viable tract" is "a tract considered by BOEM to have the potential capability of being explored, developed and produced profitably." BUREAU OF OCEAN ENERGY MGMT., SUMMARY OF PROCEDURES FOR DETERMINING BID ADEQUACY AT OFFSHORE OIL AND GAS LEASE SALES 6 (2016), https://www.boem.gov/sites/default/files/oil-and-gas-energy-program/Energy-Economics/Fair-Market-Value/Summary-of-Procedures-For-Determining-Bid-Adequacy.pdf [https://perma.cc/KZG2-XE7E]. In January of 2023, the BOEM solicited comments on its intention to revise its bid adequacy procedures. *See* Modifications to the Bid Adequacy Procedures for Offshore Oil and Gas Lease Sales, 88 Fed. Reg. 3433 (proposed Jan. 19, 2023).

[422] Modifications to the Bid Adequacy Procedures for Offshore Oil and Gas Lease Sales, 88 Fed. Reg. at 3434.

[423] BUREAU OF OCEAN ENERGY MGMT., *supra* note 418, at 2.

[424] 30 C.F.R § 556.516.

[425] James L. Smith, *Non-Aggressive Bidding Behavior and the "Winner's Curse*," 19 ECON. INQUIRY 380, 383 (1981); *see also* Douglas K. Reece, *Competitive Bidding for Offshore Petroleum Leases*, 9 BELL J. ECON. 369, 370 (1978) (modeling competitive bidding in offshore leasing system and characterizing lease sales as possessing high levels of uncertainty about lease values).

bids are not offered at lower than fair market value. Still, even with the bid adequacy review process, sealed bids are unlikely to result in an exact proximation of the resource's market value. As each firm has an incentive to bid less than its maximum willingness to pay, the auction will not be fully "demand revealing."[426] In contrast, the onshore lease process is an English auction.[427] It does not have the possibility of rogue high bids and, while potentially more reflective of demand, may not capture the maximum willingness to pay.[428]

2. Produced Water Disposal

The BLM allows use of pore space for subsurface injections under the program for produced water disposal. For on-lease disposal of produced fluids the operator only needs to file a sundry notice with a copy of the injection permit.[429] No additional property rights are required because the oil and gas lease is considered to include the right to inject. However, a separate ROW authorization is required for injections facilities including wells, roads, and pipelines located off the oil and gas lease and on federal land.[430] According to the Forest Service Manual ("FSM") on Special Use Authorizations, a special use authorization is not required for the subsurface disposal of water from oil and gas operations on USFS lands when the BLM has jurisdiction over those operations.[431] However, the FSM does direct parties to consult with the Office of General Counsel on a case-by-case basis to confirm that a special use authorization is not required for the proposed injection.[432]

Like pore space ROWs, produced water injection well ROWs are issued under title V of FLPMA and 43 C.F.R. § 2800.[433] There is no uniform rental schedule. Instead, each state office has the opportunity to develop a rental schedule for produced water disposal facilities.[434] In the absence of a rental schedule, the rent

[426] James C. Cox, R. Mark Isaac & Vernon L. Smith, *OCS Leasing and Auctions: Incentives and the Performance of Alternative Bidding Institutions*, 2 SUP. CT. ECON. REV. 43, 49 (1983); Terrence J. Schroepfer, *Allocating Spectrum Through the Use of Auctions*, 14 HASTINGS COMMC'NS & ENT. L.J. 35, 39-43 (1991).

[427] Schroepfer, *supra* note 426, at 39.

[428] *Id.*

[429] 43 C.F.R. § 3177.6(a) (2024).

[430] *Id.* § 3177.5.

[431] No cases, regulations, or notices in the federal registrar were found for injections on USFS lands where the BLM did not have jurisdiction. 36 C.F.R. § 251.53(l)(1); U.S. FORESTRY SERV., *supra* note 315, § 2711.7(3).

[432] *See* U.S. FORESTRY SERV., *supra* note 315, § 2711.7.

[433] 43 C.F.R. § 3177.5.

[434] *See, e.g.*, *Rental for Produced Water Injection Facilities and Wells*, BUREAU OF LAND MGMT. (Jan. 22, 2013) [hereinafter BLM, *Rental for Facilities and Wells*], https://www.blm.gov/policy/im-wy-2013-019 [https://perma.cc/P4DG-G7DQ].

is determined by appraisal based on comparable rental data.[435] Wyoming is one of the few states with established schedules for produced water injection facilities located in the state—IM WY-2013-019 establishes rentals for both commercial and noncommercial produced water injection facilities.[436] The rental schedule includes a per-barrel fee for injections—a type of per-unit fee—and a per-acre facility fee.[437] Wyoming's current rental schedule sets a $0.05-per-barrel rate for noncommercial disposal and a $0.10-per-barrel rate for commercial disposal.[438] The $0.05-per-barrel rate applies when a single operator requires a ROW to inject substances related to its operations, whereas commercial injection activities dispose of waste from more than one operator for a fee.[439] The schedule also establishes a per-acre fee, not for the area of the subsurface plume, but for the above-ground acreage used for the well, pad, compressors, and other related facilities. This dual structure takes into consideration the intensity and purpose of the use—as represented by the volumetric payment—and a fee for use of the surface.

3. Gas Storage Facilities

Gas storage facilities are used for temporary storage of gas in pore space, with several projects currently operating on federal land.[440] During periods of overproduction, gas storage operators can inject gas for storage and subsequently withdraw it in periods of higher demand. Natural gas storage facilities are regulated by the Federal Energy Regulatory Commission ("FERC"), pursuant to the Natural Gas Act.[441] Although the FERC can grant rights of eminent domain to natural gas companies for storage facilities, those rights of condemnation do not apply vis-à-vis the federal government. Accordingly, a ROW or other authorization for use of federal land is necessary

[435] *See, e.g.*, Goldmark Eng'g Inc., 137 IBLA 303, 305 (1997) (citing 43 U.S.C. § 1764(g) (1994)) (permitting rental adjustment following appraisal of fair market rental value, absent error of appraisal method).

[436] *See* BLM, *Rental for Facilities and Wells*, *supra* note 434 (citing 43 C.F.R. § 2806).

[437] *Id.*

[438] *Id.*

[439] *Id.*

[440] *See, e.g.*, Spire Storage West, LLC.; Notice of Availability of the Final Environmental Impact Statement for the Proposed Clear Creek Expansion Project, 87 Fed. Reg. 15983 (Mar. 21, 2022).

[441] 15 U.S.C. § 717c(f)(1).

to authorize gas storage thereon.[442] The BLM can grant authorizations for gas storage under either the MLA[443] or title V of FLPMA.[444]

Section 226(m) grants the Secretary the right to approve "operating, drilling or development contracts, and subsurface storage."[445] This allows gas storage within federal oil and gas leases, "whether or not produced from lands owned by the United States."[446] Federal regulations related to Cooperative Conservation Provisions provide that the Secretary can authorize subsurface storage of oil and gas to "avoid waste and to promote conservation of natural resources."[447] Additional provisions authorize the secretary to enter gas storage agreements within the National Petroleum Reserve-Alaska ("NPR-A").[448] In both cases, a processing fee and rental is required.[449] The regulations provide little guidance on how these rentals would be calculated. For lands outside the NPR-A, the payment must be "adequate,"[450] and for lands inside the NPR-A, the applicant must propose a rental "based on the value of the subsurface storage, injection, and withdrawal volumes, and rental income or other income generated by the operator for letting or subletting the storage facilities."[451] As of 2013, the BLM had thirty-six gas storage agreements.[452]

The BLM's other authority to grant storage rights arises under FLPMA. As with sequestration projects, a gas storage ROW is requested by filing BLM's Standard Form 299 and issued according to the terms of BLM's 2800 Manual.[453] However, there is no specific guidance that pertains exclusively to appraisals of gas storage grants.

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[442] *See, e.g.*, Ryckman Creek Resources, LLC; Notice of Availability of the Environmental Assessment for the Proposed Ryckman Creek Storage Field Project, 76 Fed. Reg. 24015, 24015-16 (Apr. 29, 2011) ("BLM has the authority to issue underground gas storage agreements and right-of-way grants for all affected federal lands.").

[443] 30 U.S.C. § 185(f).

[444] *Id.* § 226(m).

[445] *Id.*; 43 C.F.R. § 3161.2 (2024).

[446] 43 C.F.R. § 3105.42 (2024); *see also* Am. Nat. Gas Prod. Co., 49 IBLA 230, 232 (1980) (citing 30 U.S.C. § 226(j) (1976)) (recognizing BLM's authority).

[447] 43 C.F.R. § 3105.42.

[448] *Id.* § 3138.10.

[449] *Id.* §§ 3105.42, 3138.11.

[450] *Id.* § 3105.42.

[451] *Id.* § 3138.11(a)(4).

[452] *Functions Required by the Bureau of Land Management to Implement Gas Storage Agreement Payment Verification Through the National Operations Center*, BUREAU OF LAND MGMT. (April 15, 2013), https://www.blm.gov/policy/im-2013-075 [https://perma.cc/4HZC-EQ8S].

[453] *See 2801 – Rights-of-Way – General*, BUREAU OF LAND MGMT., https://www.blm.gov/sites/blm.gov/files/uploads/mediacenter_blmpolicymanual2801.pdf [https://perma.cc/6SDW-4QR8] (last visited Mar. 19, 2025).

4. Renewable Energy Rights of Way

ROWs for wind and solar royalties are closer to those for oil and gas in that they share resource and production uncertainty, though not depletion. Once the volume of production is determined, it is multiplied by the megawatt rate, which is a factor of both the value of the energy (megawatt price) and the rate of return.[454] The price is either based on wholesale electricity prices of major trading hubs in western states or on the actual price received by the ROW holder under a power purchase agreement.[455] A recently finalized rule has reduced the megawatt price by 80% until 2036, subject only to a fixed annual adjustment set at the beginning of the grant or lease period.[456]

Solar and wind capacity fees bear many similarities to royalties but differ in one fundamental sense. Rather than giving the federal landowner a share of the value produced, the fee provides a rate of return. A capacity fee first values the resource by multiplying the volume by the price. However, because the resource is renewable, the rental structure treats the wind or solar developer as if it is using the resource, rather than extracting it, and thus results in a reasonable rate of return.

In addition to a per-megawatt-hour capacity fee, the federal government assesses per-acre rentals for the grant of solar and wind ROW development grants. Rentals reflect the value of the land that will be used for the renewable energy development at the time the ROW is issued. Because renewable energy resources consume surface resources through land use conversion, rental fees take into consideration both the value of the land and the extent to which the facility encumbers the land—called an encumbrance factor.[457] Under current rules, land values are determined based on a rent schedule published by the BLM.[458] Encumbrance factors are lower for wind resources, which leave approximately 90% of the land available for grazing, cultivation, and other purposes.[459] By comparison, solar projects have a 100% encumbrance factor.[460] These variables are determined according to the guidance in BLM Land Resources Management Manuals. The product of the land value and the encumbrance factor is then multiplied by an annual rate of return.[461] In May of

[454] 43 C.F.R § 2806.52(b)(1) (2024).

[455] *Id.* § 2806.52(b)(1)(i).

[456] Rights-of-Way, Leasing, and Operations for Renewable Energy, 89 Fed. Reg. 35634, 35657 (May 1, 2024) (codified at 43 CFR pt. 2800) ("The final rule sets the capacity fee at 20 percent of the wholesale price per MWh or alternative MWh rate through calendar year 2035.").

[457] *Id.* at 35653.

[458] 43 C.F.R. § 2806.52 (2024).

[459] *MS2086- Rent (P)*, BUREAU OF LAND MGMT. (May 26, 2022) [hereinafter BLM, *Rent*], https://www.blm.gov/sites/default/files/docs/2022-05/MS-2806%20rel%202-307%20Chapter%206.pdf [https://perma.cc/KP5S-RH4N].

[460] *Id.*

[461] 43 C.F.R. § 2806.20(b).

2022, consistent with authority granted by the Energy Act of 2020, this rate of return was reduced from 5.27% to 2% in an effort to incentivize renewable energy development on federal land.[462] Furthermore, the BLM's recently issued rule eliminates the use of an annual rate of return, instead using the NASS Cash Rents Survey value multiplied by the encumbrance factor.[463] Rental payments for renewable energy development ROWs continue after the commencement of energy generation activities.[464] This system assures that the BLM receives fair value for both the use of the surface lands and the available renewable resource throughout the project duration.

B. *Valorizing Federal Pore Space*

Geologic sequestration projects have several characteristics that distinguish them from other resource development projects on federal land. Operationally, pore space projects may require greater exclusivity. To obtain a Class VI permit to inject, a grantee must demonstrate that it has access to not only the injection site, but also to the footprint of the CO_2 plume and pressure site for ongoing corrective action, monitoring, and verification.[465] The grantee must further provide financial assurances to cover potential harms, including those related to migration and trespass.[466] Pore space projects also encompass a much larger subsurface area than many oil and gas and other authorizations, potentially requiring hundreds of thousands of acres, as with the Moxa Carbon Storage project.[467] And finally, the grantee's use may be for a longer time than is required for many other kinds of projects. Permitting, geologic characterization, and well construction activities take longer for sequestration than for oil and gas,[468] and injection and postinjection monitoring activities may go on for decades.[469]

Geologic sequestration projects are also distinct because they permanently exhaust the federal pore space resource. Not only would the storage capacity be

[462] BLM, *Rent*, *supra* note 459, at 6-1 to 6-2.

[463] 43 C.F.R. § 2806.52.

[464] *See id.*

[465] 40 CFR § 146.84 (2024).

[466] *Id.* §§ 146.85, 146.93.

[467] BLM, *Southwest Wyoming*, *supra* note 112, at 1 ("Total federally managed BLM lands requested for the right-of-way is 605,091 acres.").

[468] *See* EPA, EPA 816-R-11-020, GEOLOGIC SEQUESTRATION OF CARBON DIOXIDE: UNDERGROUND INJECTION CONTROL (UIC) PROGRAM CLASS VI WELL CONSTRUCTION GUIDANCE 1 (2012), https://www.epa.gov/sites/default/files/2015-07/documents/epa816r11020.pdf [https://perma.cc/4FF7-G9CG] (describing extensive construction requirements, noting "[t]he time frame of Class VI injection will likely be considerably longer than is typical in Class II wells").

[469] EPA, EPA 816-R-16-006, GEOLOGIC SEQUESTRATION OF CARBON DIOXIDE, UNDERGROUND INJECTION CONTROL (UIC) PROGRAM CLASS VI WELL PLUGGING, POST-INJECTION SITE CARE, AND SITE CLOSURE GUIDANCE ii (2016), https://www.epa.gov/sites/default/files/2016-12/documents/uic_program_class_vi_well_plugging_post-injection_site_care_and_site_closure_guidance.pdf [https://perma.cc/YCT7-27AS].

depleted, but following injection of carbon dioxide into the formation, neither the injector nor the pore space owner would retain any right to remove the CO_2.[470] As a result, that formation would be perpetually unusable for any use inconsistent with permanent geologic storage. Additionally, liability considerations and the continuing monitoring and verification obligations required under Class VI[471] make it unlikely that subsequent grantees would conduct incremental injection activities following conclusion of the initial project. As a result, any injection of CO_2 could have the legal effect of exhausting the injection formation. This is not wholly unlike oil and gas, except that when an oil and gas lease ends, the depleted formation can serve new purposes.[472] In contrast, geologic sequestration results in a permanent encumbrance on the land, around which all future uses will need to be managed.

The BLM's IM 2022-041 suggests that ROWs for geologic sequestration should, like many other uses of federal land, include a per-unit fee and a rental.[473] A review of the compensation structures for other ROWs and subsurface authorizations in federal land reveals several commonalities that can be applied in the context of sequestration ROWs and that could inform assessments of rental value for indirect trespasses into federal pore space. This Section approaches the question of how pore space could be valorized in two parts: the structure of rentals and the establishment of value. It then considers the implications of doing so on mineral- and climate-related subsurface uses. This Section focuses only on valuing the pore space and does not consider how rents should be assessed for facilities placed on the surface of federal lands. Most of these uses—pipelines, compressors, transmission lines, and well pads—have established rental schedules or could be assessed based on comparable transactions.[474] Additionally, not all storage operators will elect to locate facilities on federal lands if adjacent state or private lands are accessible.

1. The Structure of Rentals

a. *Volumetric Payments*

The value of pore space depends on numerous factors, but perhaps chief among them are reservoir characteristics—porosity, permeability, thickness,

[470] Subsequent removal would trigger a clawback of any § 45Q tax credits. *See* 26 C.F.R § 1.45Q-5 (2024).

[471] 40 C.F.R. § 146.93 (2024).

[472] *Land Use Planning and NEPA Compliance for Oil and Gas Leasing*, BUREAU LAND MGMT., https://www.blm.gov/programs/energy-and-minerals/oil-and-gas/leasing/land-use-planning [https://perma.cc/7TMW-842K] (last visited Mar. 19, 2025) (stating after oil and gas lease ends, BLM returns land to multi-purpose use).

[473] BLM, *Right-of-Way*, *supra* note 26.

[474] 43 C.F.R. § 2806.20 (2024); *see* BUREAU OF LAND MGMT., BLM HANDBOOK H-3809-1, SURFACE MANAGEMENT HANDBOOK (2012), https://www.blm.gov/sites/blm.gov/files/H-3809-1.pdf [https://perma.cc/P64F-K7GT].

pressure, salinity, and depth.[475] These reservoir factors ultimately impact the amount of CO_2 that can be commercially stored.[476] Yet, while volumetric traits such as these have a significant impact on the value of the pore space, they will most likely be unknown to both parties at the time of contracting.[477] Even with seismic surveys and stratigraphic test wells, uncertainty remains about the true extent and performance of the reservoir.[478]

A per-unit fee, such as that suggested by the BLM, allows the parties to share in the *uncertainty* of the subsurface extent of the resource, but not the *risk* of development.[479] For sequestration, the principal uncertainty relates to how much CO_2 can be injected.[480] Therefore, the per-unit fee should be based on the volume—reflected as a measure of tons of CO_2 injected. Section 45Q already requires an operator to measure CO_2 at the point of injection,[481] so determining this volume should be straightforward. The more difficult task is to determine how the volumetric fee would be valued. Existing methods of valuing production capacity for other depletable subsurface resources suggest two possibilities: a royalty fee and a capacity fee.

The royalty model is used for both wind and solar ROWs and oil and gas leases.[482] Royalty requires assessment of two variables in addition to the volume. The first factor, the royalty fraction, is the share provided to the resource owner.[483] For oil and gas, notwithstanding that different oil fields have different production profiles and economics, most federal leases assessed a standard one-eighth royalty up until very recently.[484] Though Congress set the royalty, at times this royalty was deemed too high to allow the development of certain marginal

[475] EPA, EPA 816-R-13-004, GEOLOGIC SEQUESTRATION OF CARBON DIOXIDE: UNDERGROUND INJECTION CONTROL (UIC) PROGRAM CLASS VI WELL SITE CHARACTERIZATION GUIDANCE 2 (2013), https://www.epa.gov/sites/default/files/2015-07/documents/epa816r13004.pdf [https://perma.cc/ZYL4-S849].

[476] Catherine Callas et al., *Criteria and Workflow for Selecting Depleted Hydrocarbon Reservoirs for Carbon Storage*, APPLIED ENERGY 2-4 (July 21, 2022), https://doi.org/10.1016/j.apenergy.2022.119668.

[477] EPA, *supra* note 475, at 35-36.

[478] *Id.*

[479] Stephen F. LeRoy & Larry D. Singell, Jr., *Knight on Risk and Uncertainty*, 95 J. POL. ECON. 394, 395 (1987).

[480] EPA, *supra* note 475, at 45, 55-57.

[481] I.R.C. § 45Q(c)(1).

[482] 30 C.F.R. § 1202.52 (2024).

[483] *See* discussion *supra* Section III.A.1.a. and accompanying notes.

[484] One notable exception to the standard one-eighth royalty is with regard to the Osage Nation's mineral estate, which reserves a 16.66% royalty of the gross proceeds from sales after deducting the oil used by lessee for development and operation purposes on the lease. 25 C.F.R. § 226.11 (2024). In 2023, the BIA proposed new regulations to further strengthen the tribe's royalties as part of a settlement related to the agency's historic mismanagement of the tribe's mineral estate. Mining of the Osage Mineral Estate for Oil and Gas, 88 Fed. Reg. 2430, 2435-42 (proposed Jan. 13, 2023) (to be codified at 25 C.F.R. pt. 226).

assets.[485] In those scenarios, the Secretary had discretion to adjust the royalty based on hardship.[486] The second factor is the price. Together with the volume, these two factors are meant to capture the *value* of the resource extracted. Determining a price is where use of a royalty becomes difficult for sequestration projects. Unlike oil, which has a market value when removed from the surface, there is currently no U.S. market price for a ton of CO_2 injected for storage.[487]

The closest publicly available proxy for a price for CO_2 injection is the section 45Q credit established by Congress. However, this credit does not reflect the value of the pore space resource. Instead, it is meant to compensate for the cost of CO_2 removal. The § 45Q credit value is paid to the owner of the capture equipment and not necessarily the injector.[488] The credit varies significantly depending on the technology used to capture the CO_2 and the ultimate purpose for which it is sequestered. For example, a taxpayer with DAC equipment can claim a credit of $180 per ton for geologic storage and $130 per ton for use in enhanced oil recovery ("EOR").[489] In contrast, a taxpayer capturing point-source generated CO_2 would claim either $80 or $65 dollars respectively for the same operation.[490] As DAC costs significantly more than point-source capture, the differential in the credit amount is intended to provide the injector with a credit that is large enough to pay the DAC operator enough for the CO_2 to cover its costs of capture as well as a rate of return.[491] Similarly, the cost differential between geologic storage and EOR reflects that EOR renders a separately marketable product (oil) from which the injector derives other financial benefit

[485] Laura B. Comay, Cong. Rsch. Serv., IF 11649, Federal Offshore Oil and Gas Revenues During the COVID-19 Pandemic (version 8, 2021), https://crsreports.congress.gov/product/pdf/IF/IF11649 [https://perma.cc/QZ4A-2V9H]. As required by the Inflation Reduction Act, in April of 2024, the BLM finalized rules that update the royalty for onshore federal oil and gas leases issued after August 16, 2022 to 16.67%. *See* Fluid Mineral Leases and Leasing Process, 89 Fed. Reg. 30916, 30975 (Apr. 23, 2024) (to be codified at 43 C.F.R. §§ 3100-3180).

[486] 30 U.S.C. § 1721a(a).

[487] Comparatively, the European Union's Emissions Trading Scheme ("ETS") facilitates market establishment of the price per ton of CO_2. *Putting a Price on Carbon with an ETS*, WORLD BANK https://www.worldbank.org/content/dam/Worldbank/document/Climate/background-note_ets.pdf [https://perma.cc/SDW3-6WVU] (last visited Mar. 19, 2025).

[488] I.R.C. § 45Q(a).

[489] The dollar amount for each ton of qualified carbon dioxide captured via DAC and stored pursuant to the requirements of I.R.C. § 45Q is $36 per ton of CO_2 that is permanently sequestered and $26 per ton of CO_2 used in CO_2-EOR. *Id.* § 45Q; 26 C.F.R. § 1.45Q-1 (2024). If taxpayers who claim the credit meet prevailing wage requirements under the Davis Bacon Act, they are eligible for a five-times multiplication of the credit amount, resulting in a maximum credit of $180 and $130 per ton, respectively. I.R.C. § 45Q(h)(3).

[490] I.R.C. § 45Q; 26 C.F.R. § 1.45Q-1.

[491] INT'L ENERGY AGENCY, DIRECT AIR CAPTURE: A KEY TECHNOLOGY FOR NET ZERO 69 (2022), https://iea.blob.core.windows.net/assets/78633715-15c0-44e1-81df-41123c556d57/DirectAirCapture_Akeytechnologyfornetzero.pdf [https://perma.cc/L3B9-RPNB].

to recoup its costs of injection. As this illustrates, the credit structure does not represent the value of the storage resource but instead the cost of injection. Using the credit as the "price" for the purpose of determining royalty would arbitrarily make pore space used for DAC storage higher value than that used for other purposes because it is a more costly endeavor, not a more profitable one. Using § 45Q to determine the royalty also does not reflect the commercial model of the injector using the pore space. Section 45Q allows a taxpayer operating capture equipment to contract with a third-party injector and pay an injection fee.[492] While many CCS project developers are vertically integrated—owning the capture, transport, and disposal infrastructure, in addition to operating the entire system on behalf of emitters[493]—others may provide injection as a separate service.

It could be possible to tie the price used for a royalty to other metrics, but this would create it owns distortion. For example, a royalty could be tied to the social cost of carbon ("SCC").[494] The SCC is a metric developed by an Interagency Working Group during the Obama Administration for use in regulatory costs-benefit analyses.[495] It estimated the amount of damage done by emission of an additional ton of carbon.[496] A royalty tied to this would look at the value of sequestration as measured by the avoided harm. However, injectors are not paid based on the SCC, and, based on current SCC and § 45Q rates, the cost of mitigation currently exceeds the estimated harm of emissions. This may not, therefore, reflect fair value. The public would be receiving its share of the value of the project in terms of avoiding climate harm but not based on the value of the public resource being used.[497]

Both of these royalty methods have an additional problem: Many uses of pore space have other revenue models. For example, a commercial injector of produced water could use the same resource but realize much lower fees for injections of water on a volume equivalent basis. An oil and gas producer

[492] 26 C.F.R. § 1.45Q-1.

[493] *See, e.g.*, LAPIS ENERGY, https://www.lapisenergy.com/ [https://perma.cc/69XM-NKGT] (last visited Mar. 19, 2025) (offering full-service CCS development and operations).

[494] *See* EPA, EPA REPORT ON THE SOCIAL COST OF GREENHOUSE GASES: ESTIMATES INCORPORATING RECENT SCIENTIFIC ADVANCES 1 (2023), https://www.epa.gov/system/files/documents/2023-12/epa_scghg_2023_report_final.pdf [https://perma.cc/RF54-CQHM].

[495] *Id.* The referenced Interagency Working Group was disbanded in 2017 under the first term of President Donald J. Trump. *See* Exec. Order No. 13783, 3 C.F.R. 314, 316 (2018). It was then reestablished by the Biden Administration in 2021. *See* Exec. Order No. 13990, 3 C.F.R. 427, 431 (2022).

[496] EPA, *supra* note 494, at 1.

[497] In addition to these considerations, new regulations may soon prohibit federal agencies from considering SCC altogether, at least during the current presidential administration. A new executive order issued by President Trump in the first week of his second term again disbanded the group, also going further to instruct the EPA to issue guidance for the elimination of SCC calculations from "any Federal permitting or regulatory decision." Exec. Order No. 14154, 90 Fed. Reg. 8353, 8356 (Jan. 25, 2025).

injecting its own wastes would have no income from the injection but would realize the avoided cost of commercial disposal. A royalty based on the revenue generated from each ton injected would then set the value based on the specific type of use, in contrast to standards requiring valuations to be based on the highest use. This could distort competition and markets for pore space.

A capacity fee addresses some of these problems. It would assess a fixed price per unit of production, which is the method used in produced water injection leases.[498] Because produced water ROWs do not grant rights in the subsurface explicitly, the produced water injection fees are a measure of the intensity of use rather than the volume stored in the federal subsurface.[499] A capacity fee is simple to administer but does not allow the federal landowner to share in market risk. If the values received for CO_2 storage fluctuate significantly, the amount of the fee would remain constant. This prohibits the landowner from sharing in the benefit if markets go up and could mean that injectors are paying a larger share of total revenue received to the landowner if markets go down.

Some injection agreements have addressed this challenge by indexing the injection fee to § 45Q so that the fee would increase or decrease proportionately or by requiring payment of royalty on any revenue generated beyond current § 45Q levels.[500] Yet, while this index avoids the distinction between CO_2 sources (point-source versus DAC), it is also an imperfect and distorted index. The sequestration activities proposed today are likely to focus on the lowest cost of capture emitters—those with relatively pure and high-volume streams of CO_2—and the highest quality pore space, i.e., that which has the best volumetric and injectivity profiles and which is closest to point sources.[501] Congress may increase the § 45Q credit in the future to encourage capture from point sources with higher costs of capture or to encourage injection into suboptimal pore space with higher costs of injection. As the optimal storage resources are depleted, sequestration may shift towards lower value, or unconventional pore space, that requires more compression, more transport, or which is subject to greater geologic uncertainty. This pore space may be inherently lower value than that which is used under the current credit. As a result, an increase in the credit amount may in fact be inverse to the value of pore space. Thus, indexing to § 45Q is arbitrary.

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[498] BLM, *Rental for Facilities and Wells*, *supra* note 434.

[499] *See, e.g.*, *id.*

[500] Leases issued by the Louisiana Department of Natural Resources include capacity payments that are indexed to § 45Q. *See* State of Louisiana, *Carbon-Dioxide Storage Agreement*, DEP'T OF ENERGY & NAT. RES. (Oct. 13, 2021), https://www.dnr.louisiana.gov/assets/OMR/media/forms_pubs/AIR_PRODUCTS_FINAL_AGREEMENT_10-22-2021.pdf [https://perma.cc/KT4D-E7DB].

[501] Ryan L. Payton et al., *Pore-scale Assessment of Subsurface Carbon Storage Potential: Implications for the UK Geoenergy Observatories Project*, PETROLEUM GEOSCIENCE 2 (Mar. 19, 2021), https://www.lyellcollection.org/doi/full/10.1144/petgeo2020-092.

One additional challenge of any per-unit method is that the *value* received for a ton of pore space injected into the ground may be the same even though the cost to inject is substantially different. Stated otherwise, the value of tax credits an operator receives is fixed, irrespective of the cost of development.[502] This may mean that a much greater percentage of the net profit is paid in royalty for some land than for others. The same is true for injection fees. An injection fee of $1.00 may be a small portion of total value in one basin, represent a significant portion of the net profit in another, or render others infeasible. At times, a fixed fee may exceed the residual or leave an insufficient return on investment for the operator, thus preventing realization of the project. At other times, the fee may be a small portion of the residual, thereby providing the operator with a tremendous rate of return. The value of the storage is more based on what can be realized through its use than its gross volume.

A net-profits interest might better account for these differences. Part of the value of pore space is the cost of utilization. While unprecedented among rentals for other depletable natural resources in federal land, a net-profits interest could provide the best mechanism of risk sharing related both to the quantity and quality of the resource.[503] With a net-profits interest, the landowner's share is paid from the residual value after deducting the operator's cost to obtain the CO_2 stream and cost of transport and injection.[504] A net-profits structure would adjust for these differential costs by providing the public with a uniform share of profits generated through the use of public lands. A net-profits structure would also allow the public landowner to participate in any other revenue streams generated by the use of public lands, including those created in voluntary offset markets.[505] For sequestration, this might be the best indication of fair market value where the resource has no inherent market value apart from the profit that can be generated through its use.

Use of a net-profits structure would depart from the models used for oil and gas, wind and solar, and produced water, which all rely on a fixed value irrespective of production costs. It would also be administratively difficult. The structure of net-profits interest would have to be carefully tailored to assure that the government only shares in resource uncertainty and cost risk and not in business risk. These considerations have their own sets of analogues in other contexts. For example, business risks could be isolated by carefully defining

[502] *See* discussion *supra* Section III.B.1.a and accompanying notes.

[503] Hayne E. Leland, *Optimal Risk Sharing and the Leasing of Natural Resources, with Application to Oil and Gas Leasing on the OCS*, 92 Q.J. ECON. 413, 433 (1978).

[504] Will Kenton, *Net Profits Interest: What It Means, How It Works, Examples*, INVESTOPEDIA, https://www.investopedia.com/terms/n/net-profits-interest.asp [https://perma.cc/NK8Y-Z5KF] (last updated July 8, 2021).

[505] *See* Lewis & Righetti, *supra* note 379; *Voluntary Carbon Markets Joint Policy Statement and Principles*, WHITE HOUSE 10 (May 2024), https://www.whitehouse.gov/wp-content/uploads/2024/05/VCM-Joint-Policy-Statement-and-Principles.pdf [https://perma.cc/RSX5-32YL].

which costs could be netted out, not unlike calculations of postproduction costs for federal oil and gas royalties.[506] Additionally, where injectors were not vertically integrated—for example where transport was provided by an affiliate—the regulations would need to specify at which point to calculate the profits, allowing net back to the point where sequestration activities began.[507]

A net profits structure could provide numerous benefits, including allowing the public to share in the incremental value of additional credits secured in voluntary markets and increasing the feasibility of marginal projects. However, it has one major weakness. In some situations, the injector may be operating at a loss or may benefit in intangible ways that would be difficult to measure. For instance, some vertically integrated injectors may decarbonize to meet demands of environmental, social, and governance ("ESG") investors or to assure favored treatment of their products where end consumers are subject to carbon taxes.[508] Even if purely altruistic, the sequestration activity would nevertheless deplete a finite public natural resource and would represent an avoided cost relative to equivalent operations on private lands.

The value of pore space will vary significantly by basin based on regulatory, volumetric, commercial, and other factors. Rather than applying a uniform fee nationwide, a basin-wide rental schedule for volumetric fees could have the benefit of avoiding time consuming appraisals while nevertheless closely approximating regional market values. Such schedules could be developed by state offices or, for interstate basins, collaboratively by offices for all states. This method would provide the benefit of a localized value reflecting basin-specific characteristics without requiring the public to internalize business risks of specific operators within a basin. Were a rental schedule developed, pore space would be valued the same for all users (CCS or otherwise) within a basin, but injectors of high volumes would pay more in total. Periodic reassessments would provide opportunities to revisit the fee as CO_2 injection markets become more mature and as depletion increases marginal costs of injection and use.

b. *Per Acre "Bonus" Payments*

The second compensation mechanism for the grant of a pore space ROW could be a bonus payment. Whereas capacity fees, royalty rates, and rentals are set, the bonus is a variable that can capture the value of the interest where there is competition for resources. Whereas in a capacity-based payment the injector

[506] 30 C.F.R. § 1202 (2024).

[507] *See, e.g.*, Marathon Oil Co. v. United States, 807 F.2d 759, 762 (9th Cir. 1986).

[508] *See, e.g.*, EUR. COMM'N SERVS., GUIDANCE DOCUMENT ON CBAM IMPLEMENTATION FOR IMPORTERS OF GOODS INTO THE EU 5 (2023), https://taxation-customs.ec.europa.eu/system/files/2023-11/CBAM%20Guidance_EU%20231121%20for%20web_0.pdf [https://perma.cc/5RWY-A5XR] (implementing standard carbon costs to prevent product relocation to countries with more lenient decarbonization policies); Technology Innovation and Emissions Reduction Regulation, Alta. Reg. 251/2022 (Can.) (requiring regulated facilities to reduce greenhouse gas emissions).

and landowner share the risk of the extent of the resource, in bonus bidding the risk is borne exclusively by the bidder.[509]

Bonus payments should be assessed on a per-acre basis, thereby reflecting the size of the area in which the holder has development rights.[510] This assessment style resembles both oil and gas leases and wind and solar leases.[511] Whereas rentals and royalties or capacity fees are set, the bonus bid allows the landowner to capture additional value for granting rights based on the relative demand for the resource compared to other opportunities. For both oil and gas leasing and competitive grants of wind and solar ROWs, the optimal rate is determined through a competitive bid process.[512] In both cases, a minimum bid sets a floor below which leases or ROWs will not be offered.[513] The bidding process is used to discover the market for the offered interest. If there is no bidding at an oil and gas lease sale, the parcel cannot be leased until it is renominated. In contrast, wind and solar leases may be issued noncompetitively. Where there is no competition for the lease, no bonus bid is required.[514]

However, competitive bonus bidding assumes that there can be only one winner. For both renewable ROWs and oil and gas leases, the grant provides the holder with the exclusive right to develop the resource during the period of the lease.[515] In contrast, the BLM has indicated in comments and communications with state regulators that the development rights conveyed by ROWs for sequestration will not be exclusive until the Class VI permit is issued.[516] If the BLM proceeds with this model, exclusivity would only be triggered by the

[509] J.K. Sebenius & P.J.E. Stan, *Risk-Spreading Properties of Common Tax and Contract Instruments*, 13 BELL J. ECON. 55, 56 (1982).

[510] This would reflect area, not volume. The volume component could be captured by the capacity fee.

[511] *See supra* Sections III.A.1.c., III.A.4, and accompanying footnotes.

[512] Maryse Jackman, *Oil and Gas Bid Rounds: How Do They Work?*, WAY AHEAD (June 27, 2022), https://jpt.spe.org/twa/oil-and-gas-bid-rounds-how-do-they-work [https://perma.cc/LNH6-ETMN]; Benjamin A. Mayer, Ankur K. Tohan & Matthew P. Clark, *BLM Signals Federal Land is Open for Renewables*, K&L GATES (July 2, 2024), https://www.klgates.com/BLM-Signals-Federal-Land-is-Open-for-Renewables-7-2-2024 [https://perma.cc/9XPZ-PYAZ].

[513] 30 U.S.C. § 226(b)(1)(B); 43 C.F.R. § 3120.1-2 (2024).

[514] 30 U.S.C. § 226(b)(1)(B); 43 C.F.R. § 3120.1-2; *see also* U.S. DEP'T OF THE INTERIOR, REPORT ON THE FEDERAL OIL AND GAS LEASING PROGRAM 8 (2021), https://www.doi.gov/sites/default/files/report-on-the-federal-oil-and-gas-leasing-program-doi-eo-14008.pdf [https://perma.cc/CW57-UP3S] ("If an area offered for lease does not receive a bid during the lease sale, the bonus bid is waived, and the area can be acquired during the next two years by the first party that pays a nominal application fee.").

[515] 43 C.F.R. § 3501.16 (noting exclusive nature of lessee's right to minerals, but not land).

[516] Summary Minutes of the U.S. Department of Energy (DOE) and Council on Environmental Quality (CEQ), DEP'T OF ENERGY 14 (May 22, 2024), https://www.energy.gov/sites/default/files/2024-08/CCUS.PTF_May.2024.Minutes_Final.8.19.24_Certified.pdf [https://perma.cc/X8VP-FG9E]; *see* BLM Letter, *supra* note 227.

authorization to inject (Notice to Proceed) and therefore the holder would not have assurance of its rights to develop at the initial time of grant. All that would be conveyed upon the initial grant of the ROW is a nonexclusive option. Since any other party could obtain the same rights by application, there would be no reason to place a bonus bid. This creates a tradeoff: While the agency prevents speculation, it foregoes the possibility of capturing value from high demand.

This challenge suggests at least two potential pathways. First, where competition exists, the BLM could initiate a competitive bonus bidding process like that outlined in 43 C.F.R. § 2804.30. In these competitive scenarios, the BLM could issue exclusive ROWs that, like an oil and gas lease, would provide the holder with an exclusive period during which to develop its project.[517] This could provide the most certainty to the developer and would generate the highest up-front payments but would require the BLM to internalize some of the project developers' risk related to permitting and meeting the stipulations of the POD. For unsold ROWs or noncompetitive ROW requests, the agency could issue nonexclusive ROWs for payment of an administrative fee. The bonus payment—determined by appraisal—could be deferred until the rights granted became exclusive, thereby creating a race-to-NTP and encouraging expeditious development.[518]

c. *Rents*

Oil and gas leases, along with wind and solar ROWs, include an annual rent. However, these rentals serve different functions.[519] In oil and gas leases, the rental compensates the federal landowner for the opportunity cost related to the delay in development and to protect against speculative leasing.[520] It is payable only until drilling operations are commenced and production is established.[521]

[517] True bid competition may be difficult to achieve due to the limited number of market participants and the lack of freely available information. *See* Radford Schantz, Jr., *Purpose and Effects of a Royalty on Public Land Minerals*, 20 RES. POL'Y 35, 41 (1994); COMM'N ON FAIR MKT. VALUE POL'Y FOR FED. COAL LEASING, REPORT OF THE COMMISSION: FAIR MARKET VALUE POLICY FOR FEDERAL COAL LEASING xix-xxv (1984).

[518] The nonexclusive pathway may present other challenges beyond the issue of valuation. Sequestration projects require extensive geologic characterization which can cost millions of dollars and take several years. Potential developers of projects on federal land may be deterred from making these investments without the guarantee of exclusive development rights.

[519] *General Oil and Gas Leasing Instructions*, BUREAU OF LAND MGMT., https://www.blm.gov/programs/energy-and-minerals/oil-and-gas/leasing/general-leasing [https://perma.cc/RN4N-BNEY] (last visited Mar. 19, 2025); *Implementing New Rates for Acreage Rent, Capacity Fee, Reductions and Payment Requirements for Solar and Wind Energy Developments*, BUREAU OF LAND MGMT. (Aug. 9, 2024), https://www.blm.gov/policy/im-2024-044 [https://perma.cc/G8JS-HPDY].

[520] Mark S. Barron, *The Future of Oil and Gas Leasing in the Second Century of the Mineral Leasing Act*, *in* THE FOUNDATION FOR NATURAL RESOURCES AND ENERGY LAW SPECIAL INSTITUTE § 6A, 6A-12 (2022).

[521] 30 U.S.C. § 226(d).

In contrast, wind and solar ROWs are paid based on the continued occupation of the surface resource, and thus can continue even after production commences.[522] While both types of rentals could be applicable to sequestration projects, neither fits well with the structure of the ROW currently envisioned by the BLM.

Sequestration projects will likely have a very long timeline for development. The process of characterization, permitting, and construction could last years. For example, the average Class VI permitting processing time for the EPA is six years,[523] although the agency aims to reduce this to twenty-four months.[524] Were ROWs exclusive, annual rentals like those provided in oil and gas leases would assure that the public received fair value for the resource during the development period. For nonexclusive ROWs, the opportunity cost and risk of speculation for the federal landowner would be significantly lower during the development period and should only be assessed during the construction period following grant of the NTP.

The second type of rental is a rental for possession of the property. Wind and solar ROWs accomplish this structure with an encumbrance fee based on agricultural land values.[525] This exact model would not work well for sequestration. First, unlike solar, wind, and facilities for produced water injection, carbon sequestration does not consume any surface resources. Its "encumbrance factor" is zero. Second, the value of subsurface storage capacity bears no relation to the value of the soil. Wind and solar rentals compensate for the loss of productivity from the encumbered portion of the surface and are thus closely tied to agricultural value. This would not work for sequestration. If applied, a project in Indiana or Florida would command a higher bonus than one in Wyoming, irrespective of the subsurface characteristics. Tying the value of the surface resources to the value of the sequestration ROW would be arbitrary.

d. *Optimizing Compensation*

The optimal contract structure for sequestration ROWs should be tailored to reflect the phases of project development. A sequestration project involves four primary periods.[526] The first is the development period. During this period, the project developer engages in characterization activities and applies for the Class VI injection permit. The second period is the construction period. This

[522] 43 C.F.R. § 2806.52 (2024).

[523] Jena Lococo, *The Permitting Program Crucial for Carbon Capture's Success*, CLEARPATH (Mar. 11, 2021), https://clearpath.org/our-take/the-permitting-program-crucial-for-carbon-captures-success/ [https://perma.cc/MDG4-AXE8].

[524] *Current Class VI Projects Under Review at EPA*, EPA, https://www.epa.gov/uic/current-class-vi-projects-under-review-epa [https://perma.cc/A6DV-6G63] (last updated Jan. 21, 2025).

[525] 43 C.F.R. §§ 2806.52, 2806.21.

[526] Jean-Philippe Nicot & Ian J. Duncan, *Science-Based Permitting of Geological Sequestration of CO_2 in Brine Reservoirs in the U.S.*, 11 ENV'T SCI. & POL'Y 14, 15 (2008).

begins upon grant of the Class VI permit to construct up until the commencement of injection. The third period is the injection period, during which CO_2 is injected into the subsurface. The fourth and final period is the stewardship period, which includes postinjection monitoring, reporting, and verification and postclosure stewardship. The optimal compensation structure during each of these periods will depend on whether the rights granted are exclusive or not.

If sequestration ROWs in federal lands are not exclusive, an administrative fee may be more appropriate than either delay rentals or bonuses. During the period of development, the public bears little risk of speculation or opportunity cost since at any point a new applicant could request an overlapping ROW. This would defeat any market setting attributes of a competitive bid process: No party would have any incentive to offer more than the minimum bid. Instead, nonexclusive ROW rentals should impose an administrative fee at the grant to ensure that the public does not bear any costs associated with the initial evaluation and issuance.[527] When exclusive development rights are ultimately granted with the NTP, the ROW should require an appraised bonus payment and rentals during the construction period leading up to injection.

In contrast, if sequestration grants are exclusive, compensation could be structured to include a bonus, delay rentals, and an injection fee in addition to an administrative fee. In a competitive process, the agency could set either the capacity fee or the bonus as the bid variable. In this situation, the rights would be exclusive upon the grant of the ROW, only allowing one company, for a set term, the right to pursue a Class VI permit. Accordingly, delay rental payments would be appropriately assessed during both the development period and construction period, ending at the start of injection.

During the injection period, compensation should be assessed volumetrically, through capacity fees or royalty. These payment structures, however, have one major drawback: they are related only to the quantity of the resource that the operator uses for storage. There is therefore an implicit assumption that any residual storage could be developed by subsequent developers. The possibility of reuse is specious. Liability concerns and stewardship obligations could mean that if injection activities cease prior to exhaustion of the resource, any unused pore space is likely to go unused. To prevent these losses, and to discourage operators from requesting more pore space than they are likely to effectively utilize, land managers could structure ROWs to require payment based on expected rather than actual use, similar to the advance royalty used in coal leases,[528] or could contract the extent of ROWs if injection rates are lower than forecasted during the bid process.

This structure leaves one major component of sequestration unaddressed: the stewardship period. The injected CO_2 would remain in the subsurface reservoir estate in perpetuity. While the NTP bonus would compensate for the

[527] 43 C.F.R. § 2804.14.

[528] *Id.* § 3483.4.

development right and the capacity fee for injection, nothing explicitly addresses compensation for storage. There are two ways to look at this problem. The first is to look at the reservoir space as a depletable resource that, at the conclusion of operations, has been fully exhausted. By this framing, no further payments should be due.[529] The second framing looks at storage as a separate and enduring use of the federal lands involving the abandonment in place of the CO_2 within the sequestration formation. If considered this way, an abandonment fee based on the diminution in value of the federal property resulting from the continued storage would be appropriate. This later structure reflects the cost approach suggested in the UAS.[530]

A hybrid of these two structures may optimize the compensation for federal sequestration ROWs. Where true competition exists, the ROWs granted should be exclusive. This would allow for market and price discovery up front through the bidding process and would encourage developers to make the costly investments needed to characterize and permit an injection well. The exclusive ROW would provide the company with greater certainty to pursue the project while assuring maximum value to the public. Where ROWs were issued noncompetitively, they could be nonexclusive, limiting opportunity costs and the possibility of speculation. In this case, the values would be determined by appraisal at the time a Class VI permit and NTP were issued.[531]

e. *Price Setting*

Most likely, the rentals for initial sequestration ROWs granted in federal lands will be determined through an appraisal process. The appraisal standards and existing precedent suggest two core principles that should guide the appraisal process.

The first principle is that the appraisal of the property should reflect its highest and best use. There are many potential uses of pore space: waste disposal, carbon sequestration, gas storage, and hydrocarbon production, among others. Setting the value based on the highest use has two benefits. First, it avoids discriminating between potential users of the same resource by providing both transparency and consistency among users. Second, it discourages waste. Presumably, if rights to the pore space are valued at the highest use, lower value uses within those formations would be discouraged. The highest and best use assessment should focus only on the resource itself, and not the potential

[529] During the stewardship period, the sequestration operator would require continued use and maintenance of roads and monitoring wells and rights of ingress and egress to the surface of the property. These could be covered through linear or areal surface ROWs, which could be assessed according to established rental schedules.

[530] *See* INTERAGENCY LAND ACQUISITION CONF., *supra* note 339, at 22-23.

[531] Another interesting facet of the non-exclusive ROW process currently proposed by the BLM is that, in states like Wyoming that include unitization laws, it provides substantial power to state agencies to determine operatorship and development rights. *See* BLM Letter, *supra* note 227.

economic implications for other resources in the same land.[532] For example, the fair market value of a grant of surface mining rights for coal does not include within it the potential losses of value from use of the same land for recreation or for oil and gas.

The second principle is that appraisals should not be adjusted based on nonproprietary policy considerations. Although addressing climate change and assuring a domestic supply of oil and gas are both priorities of Congress, these factors should not affect the appraisal. While Congress has the right to make public lands available below market value to achieve its policy objectives, executive land management agencies do not. For example, in *Mallon Oil*, an oil producer appealed an appraisal of produced water injection fees to the IBLA.[533] The operator argued that paying the high fees would result in the shutting in of some of its wells, thereby contravening Congress's desire to use public lands for oil production.[534] The IBLA determined that a BLM appraiser was correct not to consider the impact of its valuation of produced water injection fees on oil production.[535] The recent adjustment of rental rates for wind and solar ROWs provides another example. While the BLM adjusted the rental rates for wind and solar in order to encourage development of sequestration projects on federal lands, it did so only after Congress granted the Secretary the authority to do so through passage of the Energy Act of 2020.[536]

Initial appraisals of federal pore space may be challenging. The appraisal standards suggest three methods: sales comparison, income capitalization, and the cost approach. The nascent nature of pore space markets complicates each of these approaches. First, very few private agreements are recorded and available, thereby making the use of use comparable agreements in appraisal difficult. Second, even private agreements that can be located may not be true analogues.[537] Most private sequestration agreements are structured as leases or easements which grant an exclusive and unconditional right of development. Additionally, in many cases, private agreements guarantee priority and noninterference from subsequent users, rather than the reasonable accommodation applied in most federal lands. As a result, the scope of rights granted in private agreements may be more extensive. An income capitalization approach may be more like a net-profits approach, but, in some cases such as produced water disposal or carbon storage, there may be no income from the use. This may suggest that a cost approach could be most suitable for initial grants, assuring that the grant compensates for any potential environmental damage and loss of market value. In at least one condemnation case for gas

[532] *See id.*

[533] Mallon Oil Co., 104 IBLA 145, 145-46 (1988).

[534] *Id.* at 148.

[535] *Id.* at 151.

[536] *See* Rights-of-Way, Leasing, and Operations for Renewable Energy, 89 Fed. Reg. 35634, 35634 (May 1, 2024) (codified at 43 C.F.R. pt. 2800).

[537] *Cf.* Schantz, *supra* note 517, at 41-42.

storage rights, a court found that use of pore space resulted in only nominal damages where subsurface storage of gas would have "little, if any, effect on the value of [the] properties since there is no significant fair market value for such rights, and since the existence of sub-surface easements does not affect the use, enjoyment or sale price of the affected surface land."[538] Based on this standard, initial appraisals for noncompetitively issued rights of way could be very low.

With time, as more projects are developed and subsurface properties become better known, the market for sequestration leases will mature. At that point, rulemaking authorizing states to develop localized rental schedules may be preferable to the appraisal process. As with produced water injection rates, a rental schedule could be established in states with a high volume of sequestration activities. This would further allow for consideration of regional methodologies core to the question of pore space value such as fluid pressure calculations and injection efficiencies. States could, if appropriate, even develop schedules that used a zone approach for individual basins, like that for areal rents. Permitting discretionary development of basin or state-level rental schedules would reduce uncertainty and administrative burden in states with high volumes of applications while still allowing for appraisals in emerging markets.

C. *The Price of Everything, the Value of Nothing*[539]

As the title indicates, the purpose of this work is to valorize pore space and not merely to value it. Valorization is the "act of thinking or stating that something has value or is valuable."[540] Federal pore space is tremendously—and possibly uniquely—valuable both as an economic asset and for its utility to climate mitigation. Federal land includes large contiguous blocks that are minimally developed and mostly uninhabited. As a result, transactional costs and human impacts are likely to be less than those associated with projects in developed areas and with private ownership. Federal land is also the only onshore area in the United States where comprehensive subsurface land planning processes already exist, therefore providing opportunities for basin-scale resources management that optimizes use, reduces risk, and prevents waste.[541] Effectively utilizing federal pore space has the potential to bear critically on the United States' achievement of carbon removal goals.

The valorization of pore space demands critical consideration of when and where pore space is valued. This provides insight into the priorities regarding subsurface use on public land. Currently, pore space values are not assessed for injection of fluids related to oil and gas operations. If injection occurs on the

[538] Columbia Gas Transmission, LLC v. Easement for the Storage of Nat. Gas Underlying Props., No. 19-CV-6746, 2021 WL 9493533, at *3 (W.D.N.Y Nov 18, 2021).

[539] A cynic is someone "who knows the price of everything, and the value of nothing." OSCAR WILDE, LADY WINDERMERE'S FAN 79 (London, Samuel French, Ltd. 1893).

[540] *Valorization*, CAMBRIDGE DICTIONARY, https://dictionary.cambridge.org/us/dictionary/english/valorization [https://perma.cc/5PR3-WTYQ] (last visited Mar. 19, 2025).

[541] DuVivier & Righetti, *supra* note 23, at 64 n.35.

leased premises, no additional compensation is required.[542] The oil and gas operator does not need a separate right of way for this use, provided the operator files a sundry notice and has the appropriate Class II permit.[543] In contrast, if injection occurs off the leased premises, a right of way is required.[544] Rentals for the location of injection well and surface facilities are assessed according to either the established rental schedule or by appraisal, but are not assessed for occupancy of the federal pore space.[545] Presently, rentals are neither assessed nor are trespass regulations enforced for injected oil and gas fluids that indirectly migrate into federal land.[546] Thus far, pore space has been unvalued or undervalued as a public natural resource.

These uses of pore space also impose opportunity costs. These injections are using and depleting federal storage resources that would otherwise be available for carbon sequestration or other uses essential to reaching net zero goals.[547] Injection and migration of oil and gas waste fluids creates new formation penetrations and can increase fluid pressures and diminish storage capacities, thereby rendering the formations less useful for storage. The oil and gas operator does not internalize the opportunity cost associated with diminishment of the resource for storage because its rights are limited to the right of production. As a result, the operator would be encouraged to use the pore space even where net utility losses to the public exceed the incremental value of oil production.

Assessing a lower value—or no value—for these uses preferences injections by oil and gas operators over injections for carbon removal.[548] Yet, in many cases, it does not have to be thus. Existing statutes provide federal land managers with the authority to address this discrepancy. While federal oil and gas lessees have rights of surface use, these are limited to what is reasonably necessary to extract the resource "in a leasehold" and what operates for the "benefit of the

[542] For the environmental protection provisions of federal oil and gas leasing regulations that mandate all produced water be injected into the subsurface or disposed of in pits, see 43 C.F.R. § 3162.5-1(b) (2024).

[543] *Id.* § 3177.5.

[544] *Id.* § 3177.6(b).

[545] *See, e.g.*, BLM, *Rental for Facilities and Wells*, *supra* note 434.

[546] 43 C.F.R. § 3177.1-3177.7 (making no mention of rents in connection with injection wells).

[547] Pore space will also be needed for hydrogen storage. While not the focus of this paper, many of these same principles would apply. *See* Samuel Krevor et al., *Subsurface Carbon Dioxide and Hydrogen Storage in a Sustainable Energy Future*, 4 NATURE REVS. EARTH & ENV'T 102, 112-13 (2023).

[548] Notably, oil and gas companies already inject CO_2 into the subsurface for waste disposal in Class II wells, at times claiming the same federal sequestration tax credits as carbon removal operators, notwithstanding the lower regulatory and compliance costs. For example, the IRS final rule on § 45Q notes that Class II may be an appropriate UIC well permit for oil and gas production wastes. *See* Credit for Carbon Oxide Sequestration, 86 Fed. Reg. 4728, 4740 (Jan. 15, 2021) (codified at 26 C.F.R. pt. 1).

lease."[549] Unless included in part of a federal unit,[550] there is no implied right to use federal surface for the benefit of operations on adjacent lands or leaseholds. As a result, land managers could require operators to acquire ROWs for pore space under FLPMA, as they do for pipelines and production facilities.[551] For on-lease activities, newly amended regulations promulgated pursuant to the MLA provide land managers with the authority to prevent lower-value injections by imposing lease stipulations requiring the operator to "mitigate adverse impacts to other resource values."[552] This could include stipulations to protect pore space, including by requiring relocation or reclamation of facilities. For oil and gas injection operations that will result in indirect migration into federal lands, FLPMA authorizes the BLM to require ROWs just as it would for any other user of federal land and to protect federal pore space through enforcement of trespass regulations. [553]

These options, however, would still predominantly follow a first-in-time principle and do not assure that storage resources are prioritized for climate mitigation purposes. Accordingly, management of subsurface conflicts may be better aligned through comprehensive planning instead of individual decisions about ROWs or retroactive assessments for damages for trespass. Comprehensive characterization and resource assessments, cross-agency coordination, and harmonization of policies and practices among land management agencies would encourage efficient use of pore space resources and prioritization of sequestration in high potential areas. Through planning, federal land managers can proactively address issues of resource fragmentation and prevent degradation of pore space resources through suboptimal uses that could make later development for sequestration more complicated. While appropriations would be required to execute on these authorities, FLPMA provides the land managers with authority to protect these interests through its mandates to inventory federal resources and plan for their use, as well as the authority to temporarily withdraw lands on an emergency basis to preserve values that would otherwise be lost.[554]

Beyond protecting federal pore space from waste, Congress can encourage its use to accelerate expeditious and scalable deployments of CCS. While pore space interests can be *priced* though appraisals, the *value* of contiguous pore space resources to climate mitigation is immeasurable. Encouraging the effective use of federal pore space to achieve these objectives should be a congressional priority. Congress could do this in a variety of ways. First, it could provide federal agencies with the directive and resources to collect geologic data necessary to characterize storage resources, to engage in land planning processes

[549] 43 C.F.R. § 3101.12 (2024); *id.* § 2881.7(b)(1).

[550] Entek GRB, LLC v. Stull Ranches, LLC, 763 F.3d 1252, 1255 (10th Cir. 2014).

[551] 43 C.F.R. § 2881.7(b)(1).

[552] *Id.* § 3101.12.

[553] *See* discussion *supra* Section I.D and accompanying notes.

[554] 43 U.S.C. §§ 1711-1714.

in high priority areas, and to perform corrective actions on existing wells. These investments would increase the value and utility of those lands, which could then be offered up for development in competitive processes or more accurately appraised. Characterization and land planning investments would further increase value by accelerating the Class VI and development authorization processes following the ROW grant.

Congress could also use its disposition authority to make federal pore space available to private sector developers below market value to encourage investment. While agencies are required to offer lands at fair market value, Congress is not. As stated by the U.S. Supreme Court in *United States v. Trinidad Coal & Coking Co*.[555]:

> In the matter of disposing of the vacant coal lands of the United States, the government should not be regarded as occupying the attitude of a mere seller of real estate for its market value. It is not to be presumed that the small price per acre required from those desiring to obtain a title to such lands had any influence in determining the policy to be adopted in opening them to entry. They were held in trust for all the people; and in making regulations for disposing of them, Congress took no thought of their pecuniary value, but, in the discharge of a high public duty and in the interest of the whole country, sought to develop the material resources of the United States by opening its vacant coal lands to entry by individuals and by associations of persons at prices below their actual value.[556]

Congress has used this disposition authority to achieve numerous pressing policy objectives ranging from development of the railroads to opening the land in the west. Notwithstanding private windfalls, Congress could decide that accelerating development of carbon removal is worth the price.

While it might appear that charging for public land merely results in transferring capital from one hand (Department of the Treasury) to another (Federal Land Management agencies) given the current prevailing business models for sequestration, setting a submarket rental for sequestration uses of federal lands would be a mistake. Doing so is unlikely to either accelerate development of carbon removal projects or to lower the costs of decarbonization to the public. As Professor Boyd notes, making similar arguments regarding the subsidization of wind and solar and other energy infrastructure, "[i]t is a mistake to suggest that the ultimate ownership of the assets does not matter."[557] Sequestration companies, like other energy companies, are operating for a profit and not as a public service. The primary market for carbon removal is driven by federal tax credits which are for a flat amount irrespective of the costs of production. Accordingly, statutorily lowering costs of development on federal land would not lower the cost of achieving carbon removal to the taxpayer. It

[555] 137 U.S. 160 (1890).

[556] *Id.* at 170.

[557] William Boyd, *Decommodifying Electricity*, 97 S. CAL. L. REV. 937, 1017 (2024).

would merely increase the profit—and thereby the public subsidy—to the operator, functionally allowing private companies to extract rents from the public for the free use of public resources. This creates equity issues as those who would benefit from the subsidy (the shareholders of CCUS firms) would be different than those bearing the costs (taxpayers).

Subsidizing development on public lands is also unlikely to result in development of projects that otherwise would be subeconomic but could result in behavior shifts that would result in heavier uses of public land. The appraisal process should already result in low rentals (potentially no more than the recovery of administrative costs) in areas where project economics are marginal. Only projects that can generate a sufficient surplus will be developed within the current model. Because the rental rate can be adjusted based on the revenue produced by the product, making lands free would only benefit projects that were already revenue positive. The effect of this subsidy would rather be more likely to encourage project developers of profitable projects to redistribute their consumption of land to public lands because they could be obtained for "free."[558] The public would internalize the opportunity cost of this heavier use of public lands through loss of recreation, landscape, agricultural, or other values.

Setting below-market rates would also forego significant potential revenue. Public land rentals and royalties are among the most significant sources of nontax revenue, much of which is shared with the states where federal lands are located.[559] Federal pore space represents a tremendous and currently unvalued or undervalued source of natural capital. Its use could provide new sources of income, potentially replacing diminishing revenues from fossil fuels. Like fossil resources, pore space is also finite and depletable. Every ton of CO_2 injected depreciates the value of the remaining storage resource both through depletion of available capacity and by marginal utility losses as pressures increase.[560] Use, therefore, imposes a cost on the public in addition to allowing revenue generation by private users. Any valuation of ROWs for injections in public land should compensate for these capital losses.

CONCLUSION

The United States owns the pore space under millions of acres of its surface and fee property. These resources are critical to the commercial deployment of carbon sequestration in the west and to realization of Congress's climate policy.

[558] R.H. Coase, *The Marginal Cost Controversy: Some Further Comments*, 14 ECONOMICA 150, 153 (1947).

[559] BRANDON S. TRACY, CONG. RSCH. SERV., R46537, REVENUES AND DISBURSEMENTS FROM OIL AND NATURAL GAS PRODUCTION ON FEDERAL LANDS 13-16 (version 2, 2020), https://crsreports.congress.gov/product/pdf/R/R46537/2 [https://perma.cc/G868-EQUW]. Note, however, that without legislation, revenue from CCUS projects would not be shared with the states.

[560] John M. Hartwick, *Natural Resources, National Accounting and Economic Depreciation*, 43 J. PUB. ECON. 291, 292-95 (1990).

Rather than an esoteric question, the United States is on the cusp of a land rush for sequestration rights. Already, private parties have requested three-quarters of a million acres of public land pore space in the west, with many more projects in the wings.[561] These interests underlie and overlap with minerals, migration corridors, and cultural resources; are jurisdictionally fragmented across land management agencies; and are interspersed with private and state lands. The enabling statutes and regulations of the three largest land management agencies—the BLM, USFS, and DOD—provide land managers with authority to grant sequestration rights. Doing so, however, requires addressing fundamental questions about how pore space in public lands can and should be valorized for private use.

Current land management statutes and regulations demand that the public receive the fair value of grants of interest in public lands. The structures in place for oil and gas, produced water, gas storage, and renewable resources illustrate how values can be determined across depletable and renewable resources. When applied to the unique aspects of sequestration projects, these models suggest that fair market value could best be determined using a per-ton capacity fee, as well as some combination of bonus and rentals determined based on the highest and best use of the resource. To avoid behavior shifting and low value use of the resource, this model should be applied consistently for all uses—including those that are currently unpriced, such as indirect migration from produced water disposal.

While administration is critical to management of federal lands, this Article's focus on administration veils the tradeoffs implicit in the question of how to value public lands for sequestration: How do we value climate mitigation relative to other uses of public lands, and should Congress use land management policy to encourage sequestration and other climate mitigation technologies? The answer requires contemplation of the market approach that the United States has pursued related to decarbonization wherein carbon removal is commoditized. Just like oil and gas and wind and solar, CCUS projects on public lands are not operated as common infrastructure. Accordingly, while Congress's power of disposition includes the right to grant interests in public lands below market value, merely lowering the cost of using public lands would provide a windfall for sequestration operators and their shareholders. Instead, Congress should recognize the unique value of federal pore space to climate objectives and provide federal land management agencies with the funding and direction to engage in widespread resource characterization and land planning. Doing so will increase the utility of federal pore space, prevent waste of storage resources, and assure that the public receives fair value for the use of public lands.

[561] *See* CONG. BUDGET OFF., *supra* note 11, at 9-12 (providing estimations of new projects as of December 2023).