DRAFT SCOPE

GENERIC ENVIRONMENTAL IMPACT STATEMENT

CLOSED LOOP GEOTHERMAL BOREHOLES AND CLOSED LOOP STRATIGRAPHIC TEST WELLS DRILLED DEEPER THAN 500 FEET

Kathy Hochul, Governor | Amanda Lefton, Commissioner

DRAFT SCOPE FOR THE
GENERIC ENVIRONMENTAL IMPACT STATEMENT
ON THE CLOSED LOOP GEOTHERMAL BOREHOLE AND
CLOSED LOOP STRATIGRPHIC TEST WELL REGULATORY PROGRAM

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New York State Department of Environmental Conservation
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625 Broadway, Third Floor
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February 14, 2025

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Draft Scope for the Generic Environmental Impact Statement for Closed Loop Geothermal Boreholes & Closed Loop Stratigraphic Test Wells Drilled Deeper Than 500 feet

Executive Summary

The Department of Environmental Conservation (DEC) is responsible for regulating the development of subsurface energy resources in New York State in accordance with the provisions of the Oil, Gas and Solution Mining Law in Article 23 of the Environmental Conservation Law (ECL) and its implementing regulations.[1] The well types subject to regulation under ECL Article 23 include all oil, gas, underground gas storage, and solution salt mining wells of any depth, and geothermal,[2] stratigraphic,[3] and brine disposal wells drilled deeper than 500 feet below the earth's surface.

In February 2024, Governor Hochul signed legislation[4] directing DEC to promulgate regulations specific to closed loop geothermal boreholes[5] drilled deeper than 500 feet. This legislation was intended to protect the environment and public health and safety while minimizing barriers and reducing costs to accessing geothermal heating and cooling systems, to help reach the state's building decarbonization goals and the greenhouse gas (GHG) emission reductions requirements of the Climate Leadership and Community Protection Act of 2019 (CLCPA).[6] In support of this legislative intent, DEC expanded the scope of this rule making to include closed loop stratigraphic test wells drilled deeper than 500 feet, as these wells are often drilled in advance of potential closed loop geothermal energy projects to test subsurface characteristics to determine the feasibility of and technical specifications for potential projects. Stratigraphic wells drilled deeper than 500 feet, including closed loop stratigraphic test wells, are regulated in accordance with ECL

[1] More information on oil, gas and solution mining laws and regulations are available at https://dec.ny.gov/environmental-protection/oil-gas/well-owner-and-applicants-information-center/laws-rules-regulations.

[2] In September 2023, the legislature passed bill S. 6604/A. 6949, to exempt closed loop geothermal boreholes deeper than five hundred feet from regulation under ECL Article 23. In February 2024, the legislation was amended (S.8060/A.8565) to restore DEC's authority over these boreholes by directing DEC to promulgate regulations specific to these boreholes.

[3] The September 2023 and February 2024 legislation changes discussed above did not impact DEC's existing authority to regulate stratigraphic wells drilled deeper than 500 feet. As such, closed loop stratigraphic test wells deeper than 500 feet are currently regulated.

[4] NYSS. 2024. Bill S.8060/A.8565. https://www.nysenate.gov/legislation/bills/2023/A8565.

[5] "Borehole" is the terminology used in the legislation and therefore will be used throughout this document. It is synonymous with the term "well" for the purposes of the ECL Article 23 regulatory program.

[6] CLCPA requires New York to reduce economy-wide greenhouse gas emissions 40 percent by 2030 and no less than 85 percent by 2050 from 1990s levels. The Scoping Plan issued by the Climate Action Council in 2022 includes recommendations to meet CLCPA's requirements, including a vision that 85 percent of homes and commercial building spaces will be electrified with a diverse mix of energy-efficient heat pump technologies and thermal energy networks by 2050. These heat pump technologies and thermal energy networks will include geothermal well development.

§ 23-0305(14) and the current implementing regulations at 6 NYCRR Parts 550-559. If DEC adopts the proposed regulations, the implementing regulation for closed loop stratigraphic test wells will be 6 NYCRR Part 563.

The action of promulgating regulations is subject to review under the State Environmental Quality Review Act (SEQR).[7] As part of the rule making process, DEC is considering issuing permits on a project[8] basis instead of a per well basis, as done under the current ECL Article 23 permitting process. Each closed loop geothermal or closed loop stratigraphic test well project would be permitted under one permit regardless of the number of boreholes or wells. The action of issuing individual well permits for these projects also requires review under SEQR. DEC anticipates that these closed loop projects will have common impacts and therefore DEC can more efficiently evaluate these impacts on a generic level via a generic environmental impact statement (GEIS).

The first step in preparing the GEIS is for DEC to prepare a "scope" or outline of its contents. The scope refers to the outline of what the GEIS will contain. The process of creating an outline is called "scoping" to develop a written outline or "scope" of topics and analyses of potential environmental impacts of an action that will be addressed in the draft GEIS and how they will be studied. The job of scoping is to narrow issues that will be addressed in the GEIS to ensure that it will be a concise, accurate and complete document that is adequate for public review. DEC's SEQR Handbook describes the scoping process in greater detail.

In this scope, DEC outlines the topics that it proposes to assess in the GEIS regarding well permit issuance specific to closed loop geothermal boreholes and closed loop stratigraphic test wells deeper than 500 feet (the Closed Loop GEIS). DEC will accept written comments from interested parties on this draft scope and the related Advanced Notice of Proposed Rule Making (ANPRM).[9] Additionally, DEC will accept verbal comments provided at two public stakeholder meetings. DEC will consider these comments in preparation of a final scope, the draft Closed Loop GEIS, and the draft regulations. The draft regulations and the draft Closed Loop GEIS will be released concurrently for additional public review and comment. The final Closed Loop GEIS and associated Findings Statement, which will be prepared after consideration of comments received on the draft, will set additional parameters for SEQR review of individual projects. Upon finalization of the rules, DEC will then be able to issue permits for wells subject to the regulations. Refer to Figure 1 below for a visual representation of these concurrent processes. The milestones shown in light green are associated with the rule making process, the milestones shown in dark green are associated with the process of developing the GEIS, and the milestones shown in yellow are associated with opportunities for public input and comment on both the rule making and GEIS processes.

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[7] Information about SEQR and its accompanying regulations is available at https://dec.ny.gov/regulatory/permits-licenses/seqr.

[8] For the purposes of this rule making, a project is considered any closed loop geothermal borehole(s) or closed loop stratigraphic test well(s) drilled greater than 500 feet in depth. Any proposed borehole(s) or well(s) drilled shallower than 500 feet in depth are not regulated under ECL Article 23, and therefore would not be included in a permit.

[9] For additional information regarding the ANPRM for closed loop geothermal boreholes and closed loop stratigraphic test wells drilled deeper than 500 feet, please visit DEC's website at https://dec.ny.gov/regulatory/regulations/proposed-emergency-and-recently-adopted-regulations/mineral-resources.

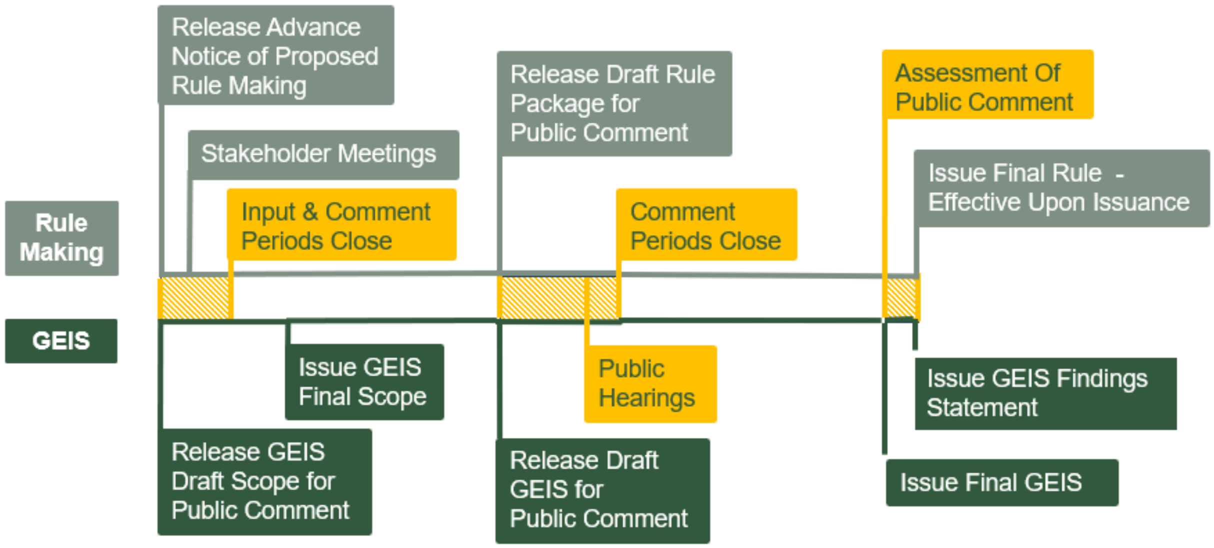

Figure 1. Rule Making and GEIS Processes

Narrative background is included in this document based on DEC's experience regulating well drilling under ECL Article 23 in New York State. This narrative is included to provide context to help the reader to evaluate the draft scope and understand its relationship with the requirements under consideration as part of the related ANPRM. Nothing contained in this draft scope is intended to convey a decision or position regarding any matters that will ultimately be addressed in the Closed Loop GEIS and regulations for both closed loop geothermal boreholes and closed loop stratigraphic test wells drilled deeper than 500 feet. Additionally, throughout this draft scope reference to closed loop geothermal boreholes and closed loop stratigraphic test wells shall be understood to mean greater than 500 feet deep.

1. Introduction

1.1. Description of the Proposed Action

There is widespread public interest in the development of geothermal wells throughout New York State, including regions that have a rich history of oil and natural gas production such as western New York, the Southern Tier, and the Finger Lakes, as well as in other areas such as the Hudson Valley, New York City, and Long Island regions.

Geothermal wells are any boreholes constructed for the purpose of obtaining, withdrawing, or accessing the geothermal properties of subsurface formations for heating or cooling, or both.[10] The installation of closed loop geothermal boreholes requires drilling to targeted depths in the subsurface, inserting a closed loop pipe/tube/coil into the drilled borehole, grouting the pipe in place from total depth to surface across the entire diameter of the borehole, and connecting the pipe to a ground source heat pump that circulates heat transfer fluid through the loops of pipe to capture and release heat from the subsurface. Closed loop boreholes use non-contact thermal

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[10] Geothermal well types include closed loop, open loop and standing column wells, as well as any well used for the re-injection of geothermal fluids.

energy from the transfer fluid in the loop and do not involve the withdrawal or injection of groundwater.

Closed loop geothermal boreholes are engineered to meet the anticipated thermal energy loads for a given space or building that they are intended to heat or cool. Lower thermal energy requirements may result in project designs consisting of a single borehole or multiple shallow boreholes. Higher thermal energy requirements may result in project designs consisting of a larger number of boreholes, boreholes drilled to greater depths to maximize thermal efficiency, and borehole construction techniques that use thermally enhanced grouts to increase thermal conductivity.

DEC proposes to satisfy SEQR for the ECL Article 23 permitting of closed loop geothermal boreholes and closed loop stratigraphic test wells drilled deeper than 500 feet, and the associated rule making process, through the preparation of a Closed Loop GEIS. For the purposes of the Closed Loop GEIS, the term "project" encompasses both smaller-scale residential installations with one to several boreholes, and larger-scale commercial projects that provide heating and cooling for a building or facility, district geothermal systems,[11] and utility thermal energy networks (UTEN).[12] Project scale may have an effect on potential environmental impacts and proposed mitigation measures, which will be discussed in the Closed Loop GEIS.

The narrative background and context provided in this document is based on DEC's experience regulating the drilling, operation, and plugging of oil, natural gas, underground gas storage, solution salt mining, brine disposal, geothermal, and stratigraphic wells in New York State and is for reference only. Nothing contained in this draft scope is intended to convey a decision or position regarding any matters that will ultimately be addressed in the Closed Loop GEIS. Additionally, throughout this draft scope reference to closed loop geothermal boreholes and closed loop stratigraphic test wells shall be understood to mean greater than 500 feet deep.

1.2. Regulatory Jurisdiction

In Article 1 of the ECL, the Legislature declared it "…to be the policy of the State of New York to conserve, improve, and protect its natural resources and environment and to prevent, abate and control water, land and air pollution, in order to enhance the health, safety and welfare of the people of the state and their overall economic and social well-being"[13] and it is DEC's responsibility to carry out this policy. As set forth in ECL § 3-0301(1), DEC's broad authority includes, among many other things, the power to:

- Manage natural resources to assure their protection and balanced utilization;
- Prevent and abate water, land, and air pollution; and

[11] District geothermal systems provide heating and cooling to residential, commercial, and community buildings such as a university campus.

[12] A utility thermal energy network (UTEN) is a utility-scale distribution system used to connect commercial and residential buildings to a community thermal energy network. In addition to geothermal energy from closed loop geothermal boreholes, the network can include other thermal sources and sinks such as surface water, waste heat, wastewater and the air.

[13] Environmental Conservation Law (ECL) § 1-0101(1).

- Regulate storage, handling, and transport of solids, liquids, and gases to prevent pollution.

ECL § 23-0301 declares it to be "…in the public interest to regulate the development, production and utilization of natural resources…" in the state in such a manner that the rights of all persons, including landowners and the public, may be fully protected.

The Legislature amended ECL § 23-0305 in 1987 to explicitly authorize DEC to regulate the drilling of geothermal wells, stratigraphic test wells, and brine disposal wells drilled deeper than 500 feet, parallel to the authority over oil, gas, and solution mining wells under the Oil, Gas and Solution Mining Law. "The drilling, or subsequent plugging of oil, gas and solution mining wells must conform to standards established to protect the health, safety and welfare of the public or to avoid adverse environmental impacts to the land or groundwater. Deep geothermal, stratigraphic and brine disposal wells have the potential to pose equivalent environmental threats. Therefore, it is appropriate to clarify DEC's authority to establish requirements for casing, cementing, and plugging such wells."[14]

ECL § 23-0305(14)(c) provides that "[t]he department shall have the power to...classify a well…and require its identification as a geothermal, stratigraphic, or brine disposal well." Additionally, ECL § 23-0305(14)(a) provides that "[t]he department shall have the power to require all exploration, drilling and development operations to be conducted in accordance with standards promulgated by the department in rules and regulations." Together, these provisions allow the DEC to define and classify wells as either geothermal or stratigraphic and promulgate regulations specific to both types, except for closed loop geothermal boreholes installed for the purpose of facilitating a geothermal heating or cooling system.

ECL § 23-0305(15) is specific to closed loop geothermal boreholes and states that "[t]he department is authorized to regulate for the purposes of protecting natural resources and the environment or public health and safety, closed loop boreholes deeper than five hundred feet below the earth's surface installed for the purpose of facilitating a geothermal heating or cooling system and…shall promulgate regulations relating to such boreholes…" This authorizes the DEC to examine the permitting, siting, drilling, operation, and decommissioning of closed loop geothermal boreholes drilled deeper than 500 feet, and to set forth rules and regulations pertaining to such boreholes that will mitigate any potential significant environmental impacts.

In addition, ECL § 23-1903(3) provides that "[t]he department shall have the authority to establish reasonable fees by rule for closed loop boreholes deeper than 500 feet below the earth's surface."[15]

ECL § 23-0303(2) provides that DEC's Oil, Gas and Solution Mining Law supersedes all local laws relating to the regulation of oil and gas development except for local government jurisdiction over local roads or the right to collect real property taxes. Likewise, ECL § 23-1901(2) provides

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[14] NYSS. 1987. ECL § 23 Memorandum of State Department of Environmental Conservation, Geothermal, Stratigraphic and Brine Disposal Wells.

[15] This grants DEC authority pursuant to ECL § 23-0305(15) to credit these fees to the oil and gas account established under chapter 58 of the Laws of 1982 for purposes of environmental protection or GHG emission reduction.

for supersedure of all other laws enacted by local governments or agencies concerning the imposition of a fee on activities regulated by Article 23.

1.3. Project Location

The rule making, Closed Loop GEIS, and its Findings will be applicable to closed loop geothermal boreholes and closed loop stratigraphic test wells drilled deeper than 500 feet in all parts of the state.

1.4. State Environmental Quality Review Act

DEC's SEQR regulations authorize the use of GEISs to assess the environmental impacts of separate actions having generic or common impacts. A GEIS and its findings "set forth specific conditions or criteria under which future actions will be undertaken or approved, including requirements for any subsequent SEQR compliance."[16] When a final GEIS has been filed, "no further SEQR compliance is required if a subsequent proposed action will be carried out in conformance with the conditions and thresholds established for such actions" in the generic environmental impact statement.[17]

In 1992, DEC released the Final GEIS on the Oil, Gas and Solution Mining Program[18] to comprehensively review the program for regulating oil, gas, underground gas storage, and solution mining wells of any depth, and brine disposal, stratigraphic, and geothermal wells deeper than 500 feet. However, DEC subsequently determined that the 1992 Final GEIS does not cover the permitting, drilling, operation, or decommissioning of closed loop geothermal projects anticipated to meet the state's climate goals as set forth in the CLCPA. Additionally, it does not evaluate the multi-borehole fields that will be developed for larger-scale applications, borehole construction techniques specific to closed loop geothermal boreholes, or appropriate setback restrictions for closed loop geothermal drilling operations. As such, DEC determined that it could not rely on the 1992 GEIS to fulfill SEQR requirements for permitting closed loop geothermal boreholes and closed loop stratigraphic test wells, which therefore warrant further review.

DEC expects that closed loop geothermal boreholes and closed loop stratigraphic wells deeper than 500 feet will have common impacts, therefore DEC can more efficiently evaluate these impacts on a generic level through a GEIS specific to these projects (Closed Loop GEIS), while addressing any unique site-specific issues during the permitting process. DEC expects that a Closed Loop GEIS will fulfill SEQR requirements not only for the rule making, but for the permitting of any future project proposal that is consistent with the descriptions and thresholds contained in the Closed Loop GEIS.

The Closed Loop GEIS will discuss the drilling, operation, and decommissioning of closed loop geothermal boreholes over 500 feet at the project scales described above in Section 1.1. Smaller-scale projects are often located in residential and commercial areas, and typically require less equipment, disturb a smaller area, and complete construction over a shorter time frame. Therefore, smaller-scale closed loop geothermal boreholes may have different, possibly less

[16] 6 NYCRR Part 617.10(c).

[17] 6 NYCRR Part 617.10(d)(1).

[18] NYSDEC. 1992 GEIS. https://dec.ny.gov/environmental-protection/oil-gas/geis.

significant environmental impacts than larger-scale projects. Depending on their nature, smaller-scale projects may also be limited in scope, requiring only an ECL Article 23 permit. In such instances, DEC expects to be lead agency for the SEQR process.

Larger-scale projects are more likely to have significant environmental impacts and may require additional permits unrelated to ECL Article 23, potentially involving a project-specific SEQR assessment to evaluate the aspects and environmental impacts of the project that are not related to the siting, drilling, operation, or decommissioning of closed loop geothermal boreholes. Aspects of larger-scale projects that are unrelated to ECL Article 23 are outside the scope of the Closed Loop GEIS. DEC will participate as an involved agency in those geothermal projects that involve coordinated SEQR processes beyond the ECL Article 23 regulatory program.

- *The Closed Loop draft GEIS (dGEIS) will evaluate potential adverse impacts associated with the siting, drilling, operation, and decommissioning of closed loop geothermal boreholes and closed loop stratigraphic test wells and determine appropriate requirements necessary to avoid, minimize or mitigate (impacts that cannot be avoided or minimized) any potential adverse impacts identified. These determinations will be made using program knowledge, review of relevant industry standards, stakeholder input, review of other state regulatory programs, research, and literature reviews where appropriate. Environmental impacts resulting from large-scale projects with their own SEQR evaluations unrelated to ECL Article 23 are outside the scope of the Closed Loop dGEIS, however the Closed Loop dGEIS will provide an explanation of the processes necessary for DEC to participate as an involved agency in any necessary coordinated SEQR evaluations.*

DEC proposes to require that applicants provide an Environmental Resource Analysis (ERA) as a component of each closed loop geothermal drilling application. This tool will help determine if additional environmental assessment and SEQR review is needed on a site-specific basis.

1.4.1 SEQR Scoping Process and Stakeholder Outreach

The primary goals of the scoping process are to focus the Closed Loop dGEIS on potentially significant adverse impacts of the proposed action and to eliminate consideration of impacts that are irrelevant or non-significant. This draft scope outlines the elements necessary to complete the GEIS for closed loop geothermal boreholes and closed loop stratigraphic test wells greater than 500 feet. A final scoping document may include additional factors and considerations identified through public outreach and the scoping process. Two virtual stakeholder outreach meetings are planned. A schedule and links for the virtual meetings will be released on DEC’s Environmental Notice Bulletin at https://dec.ny.gov/news/environmental-notice-bulletin. The public scoping sessions will provide an opportunity for stakeholders and all interested parties to comment on this draft scope. Written comments on this draft scope will also be accepted by DEC until midnight on August 22, 2025.

DEC’s Public Comment System: https://nydec.commentinput.com?id=JS9VgQZP6

Or email DMN.PublicComment@dec.ny.gov.
Please include “Closed Loop Geothermal” in the subject line.

Or mail to:
Attn: Geothermal Scope Comments
NYS DEC Division of Mineral Resources
625 Broadway, Third Floor
Albany, NY 12233-6500

1.4.2 Final Scope for the GEIS

DEC expects to release a final scope following the public meetings and a comment period on this draft scope. A copy of the final scope will be posted on DEC's website, provided to document repositories, and provided to all parties who submit written comments. The final scope will serve as the outline and table of contents for the Closed Loop dGEIS, which will be released for public comment with any proposed regulations and prior to issuance of a final Closed Loop GEIS.

2. Description of the Action

DEC intends to adopt regulations specific to closed loop geothermal boreholes and closed loop stratigraphic wells deeper than 500 feet and to issue permits for the wells subject to the regulations. The purpose of the Closed Loop GEIS is to assess the environmental impacts of the regulations and to establish a uniform set of baseline permitting conditions for the drilling, installation, and decommissioning of closed loop geothermal boreholes and closed loop stratigraphic test wells deeper than 500 feet.

The Final Scoping Plan prepared by the New York State Climate Action Council, provides a framework for how New York will reduce GHG emissions, achieve net-zero emissions, increase renewable energy use and ensure all communities equitably benefit in the clean energy transition.[19] The Final Scoping Plan regards ground source heat pump (GSHP) systems, which include close loop geothermal boreholes, as a fundamental element in New York's decarbonization efforts and a long-term replacement for fossil fuel-based heating and cooling systems. GSHPs are three to five times more efficient than fossil fuel heating systems[20] and crucial to achieving the goals of CLCPA. However, the drilling, operation, and decommissioning of closed loop geothermal boreholes and closed loop stratigraphic test wells must conform to standards established to protect the health, safety, and welfare of the public and to avoid potential adverse environmental impacts.

2.1. Closed Loop Geothermal Boreholes

GSHP systems use closed loop geothermal boreholes to access the relatively constant temperature below the earth's surface. Closed loop boreholes are drilled to a pre-determined depth. Depending on the characteristics of the subsurface, fully cemented surface casing may be required to be installed to a specified depth to ensure aquifer protection. High-density

[19] NYSCAC. 2022. Scoping Plan.

[20] NYSCAC. 2022. Scoping Plan. Ch. 12: Buildings. pg. 176.

polyethylene (HDPE) loop piping is installed in the borehole and then grouted in place, from total depth to surface, to permanently seal the borehole (Refer to Figure 2).

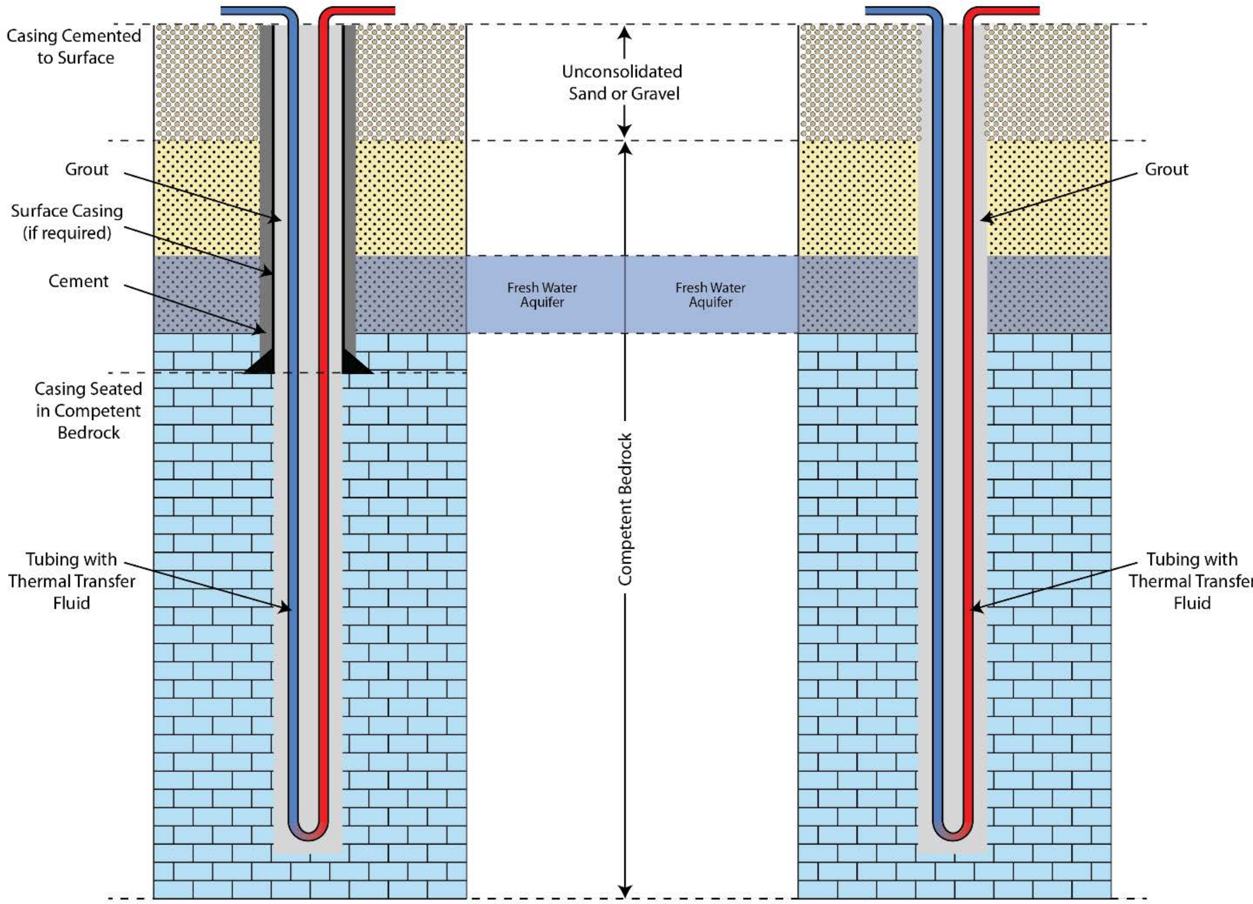

Figure 2. Cross-section of Closed Loop Geothermal Borehole Configurations

Closed loop geothermal boreholes do not involve the withdrawal or injection of groundwater. Once drilling is completed, the loop is connected to a GSHP system where heat transfer fluid circulates through the loop piping within the borehole, and the fluid exchanges heat in the subsurface through the loop and grout and then passes through a heat exchanger. The subsurface acts as a non-contact thermal energy storage reservoir, becoming a heat sink and absorbing excess heat during the summer, and a heat source providing heat in the winter. Based on the heating and cooling loads projected for a GSHP system, one or many closed loop boreholes may be required to efficiently provide heating and cooling needs to the building or residence.

- *The Closed Loop dGEIS will examine whether there are any potential environmental impacts associated with drilling and installation of closed loop geothermal boreholes using program knowledge, review of relevant industry standards, and stakeholder input.*

2.1.1. Drilling

The borehole drilling phase is one of the most critical aspects of the installation of a GSHP system and the time when the most environmental oversight is needed to prevent pollution and to protect the health, safety, and welfare of the public. When drilling wells greater than 500 feet in depth in most geographic areas of New York, the geology dictates that hydrocarbons, including natural gas or oil, and highly saline groundwater (brine) are more likely to be encountered in the subsurface than at more shallow depths. Through its regulations and permitting, DEC must therefore ensure that in geographic areas where these concerns exist, the boreholes are drilled and constructed in a manner that prevents the migration of natural gas, oil, and brine from deeper formations to more shallow formations, particularly aquifers used for drinking water. It must also ensure that any natural gas encountered during drilling is properly handled and controlled, so as not to result in blow outs or rig fires that threaten the safety of the drilling crew and the public.

- *Through the Closed Loop dGEIS, DEC will evaluate and establish appropriate drilling and borehole construction standards, including requirements for the casing and cementing, pressure testing, and grouting of these well types, as these are the primary mitigation measures used to prevent gas and fluid migration in the subsurface. These standards will be established through program knowledge, review of relevant industry standards and other state regulatory programs, and stakeholder input.*
- *Through the Closed Loop dGEIS, DEC will also evaluate and establish surface setbacks from water wells, surface water bodies, property boundaries, and buried utilities. These setbacks will be established through program knowledge, review of relevant industry standards and other state regulatory programs, and stakeholder input.*

2.1.2. Operation

At the conclusion of drilling operations, the owner of the closed loop borehole(s) is responsible for the operation and maintenance of the permitted borehole(s) in a manner that will prevent pollution and protect public safety.

- *The Closed Loop dGEIS will discuss the operational phase of closed loop geothermal boreholes and the limited potential for environmental impacts. While DEC does not currently anticipate extending regulatory oversight into the operational stage, beyond general pollution prevention and any non-routine incident reporting, this decision will be informed through the scoping, dGEIS, and rule making processes and is subject to revision.*

2.1.3. Decommissioning

When a closed loop geothermal borehole is unable to continue functioning in its intended capacity and for its permitted purpose, it must be properly and timely decommissioned. Decommissioning involves removing all heat transfer fluids from the loop, disposing of this fluid properly in accordance with existing rules and regulations, and permanently sealing the remaining loop with cement or grout. Decommissioning is typically limited in scope and cost and is necessary to prevent the borehole(s) from posing a threat to public safety or the environment.

- *Through the Closed Loop dGEIS, DEC will assess whether there are any potential environmental impacts associated with decommissioning closed loop geothermal boreholes and establish decommissioning requirements using program knowledge, review of relevant industry standards, and stakeholder input.*

2.2. Closed Loop Stratigraphic Test Wells

Closed loop stratigraphic test wells are drilled and constructed in the same manner as closed loop geothermal boreholes; however, their purpose is to evaluate the viability of and technical specifications for a proposed GSHP system. Prior to designing larger-scale geothermal systems, closed loop stratigraphic test wells are typically drilled to evaluate subsurface characteristics, such as thermal conductivity. Thermal conductivity testing for geothermal resources measures the ability of the ground to transfer or conduct heat. This conductivity measurement is required to determine the most efficient borehole depth(s), the total number of boreholes required, and the overall geothermal heat pump system design. After testing is complete, the stratigraphic test well is either converted into a closed loop geothermal borehole and integrated into a larger geothermal system or properly decommissioned and plugged.

- *The Closed Loop dGEIS will address any activities related to closed loop stratigraphic test wells that differ from closed loop geothermal boreholes and will identify any potential impacts from those activities.*

2.2.1. Drilling

As with a closed loop geothermal borehole, a properly constructed closed loop stratigraphic test well is effectively plugged at the end of construction. The wellbore is grouted from total depth to surface during construction, sealing any conduit to the subsurface and thereby preventing the migration of subsurface fluids and/or gas between formations, and the migration of any surface contaminants to the subsurface. However, the regulatory scheme related to these wells must ensure that the wells are drilled and constructed in a manner that prevents the migration of natural gas, oil, and brine from deeper formations to more shallow formations, particularly aquifers used for drinking water. Closed loop stratigraphic test wells will be subject to the same regulatory requirements as closed loop geothermal boreholes.

2.2.2. Conversion

The conversion of a closed loop stratigraphic test well to a closed loop geothermal borehole is considered a ministerial action by DEC. A closed loop stratigraphic test well is constructed in the same manner as a closed loop geothermal borehole; therefore, if the owner of the closed loop stratigraphic test well determines the downhole characteristics of the well are suitable for inclusion in a larger-scale geothermal system, the owner would submit a notice to DEC informing DEC that the well will be integrated into a GSHP system and used for geothermal heating and cooling. DEC would then issue an acknowledgement and would change the well type on record from a closed loop stratigraphic test well to a closed loop geothermal borehole. DEC does not anticipate that the change in the well type on record will pose any potential environmental impacts beyond those associated with the installation of the larger-scale geothermal project, which will be reviewed and mitigated in accordance with the process and procedures described in the Closed Loop dGEIS.

- *The Closed Loop dGEIS will include a more in-depth discussion of conversion and anticipated noticing requirements for well owners.*

2.2.3. Decommissioning

Decommissioning requirements for closed loop stratigraphic test wells will be the same as those for closed loop geothermal boreholes, as discussed above.

3. Environmental Setting

The diverse geology across New York State presents a unique challenge for permitting closed loop geothermal boreholes and closed loop stratigraphic test wells drilled deeper than 500 feet. DEC is proposing to establish regions based on bedrock geology and depositional environment to assist with the identification of risks associated with drilling throughout the state and to avoid or minimize any potential adverse environmental impacts identified through region-specific requirements.

3.1. New York Geology by Region

The geology of New York State is composed of a wide variety of bedrock types, ages, structures, and landforms. DEC is proposing to identify six regions, as shown in Figure 3, to clearly differentiate between geologic areas as they relate to the permitting, drilling, and installation of closed loop geothermal boreholes.

The Atlantic Coastal Plain encompasses most of Long Island and a portion of Staten Island. It is composed of metamorphic units overlain by sands, clays, and gravels of glacial origin. These sedimentary units can be over 2,000 feet thick and are a source of drinking water for much of the region.

The Lower Hudson & Taconics region is characterized by a range of heavily deformed rock formations. The northern portion consists of steeply dipping and intensely faulted sedimentary and metamorphic units, while crystalline metamorphic and igneous rocks make up the southern portion of this region. Portions of this region are relatively unexplored by deep drilling.

The Allegheny Plateau consists of layered sedimentary rock units overlying a predominantly granitic basement. These formations range in age from Middle Cambrian to Late Devonian and are mainly composed of carbonates, shales, and sandstones, and gently dip to the south.

The Adirondack Region is predominantly composed of Grenville-aged igneous and metamorphic rocks. The area is known for its mountainous terrain and mineral deposits.

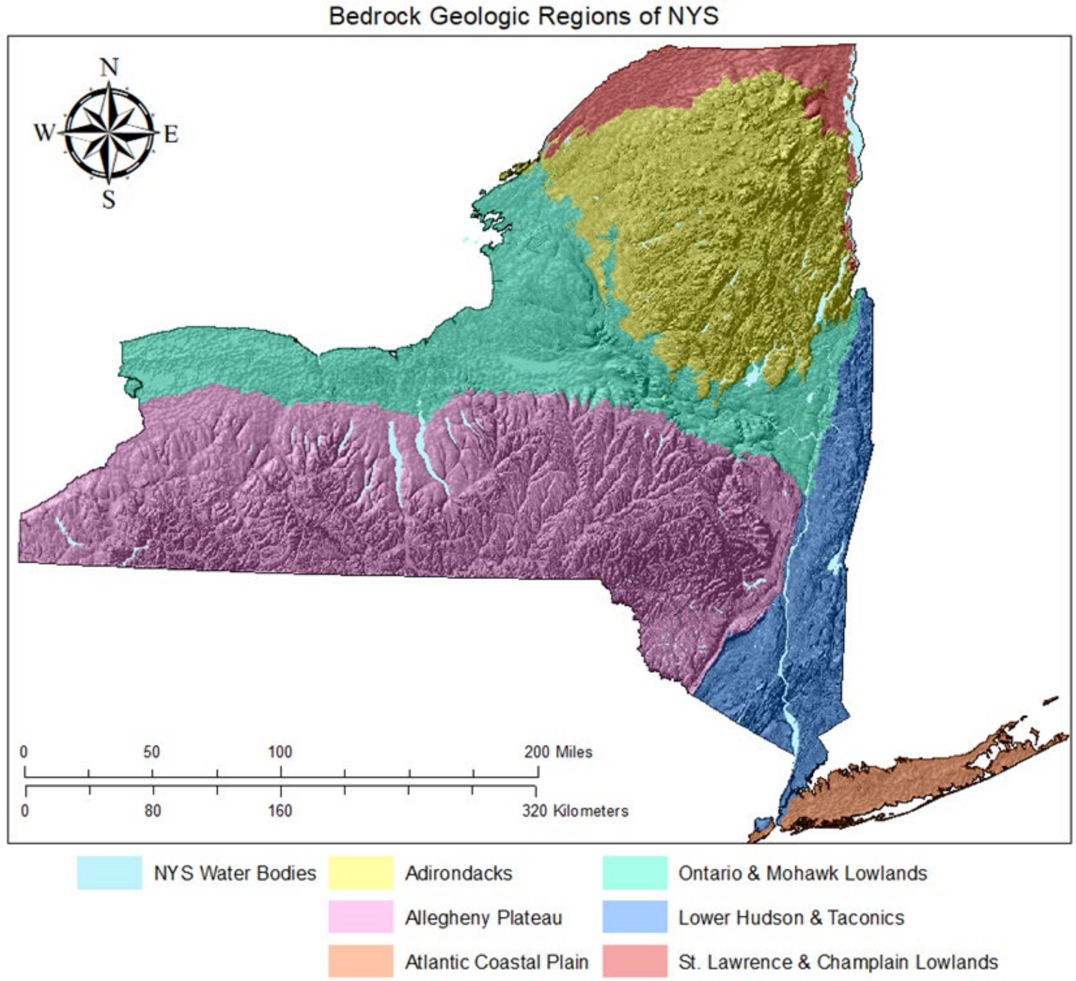

Figure 3. New York State Bedrock Geology by Region[21]

The St. Lawrence & Champlain Lowlands are composed of the same or similar Cambrian and Ordovician-aged sedimentary rocks found in the Erie-Ontario Lowlands and Allegheny Plateau. These units flank the foothills of the Adirondack Mountains, which separate them from the other sedimentary regions to the southwest.

In addition to the bedrock geology, much of New York State has been shaped by the advance and retreat of several glacial icesheets. Glacial lake deposits are extensive in many areas of the state and meltwaters from the retreat of these glaciers have led to extensive karst topography in areas with shallow carbonate formations.

- *The Closed Loop dGEIS will include a more in-depth description of the variable bedrock and glacial geology across each region and, as indicated in Sections 3.2 and 3.3 below, how this geology influences the presence of potential drilling hazards based on program knowledge and literature review.*

[21] NYSM Bedrock Geology Map, 1990, and Digital Elevation Model Hillshade, 10 meter - New York State, as modified by NYSDEC Division of Mineral Resources. 2024.

3.2. Potential Drilling Hazards

Geologic hazards may be encountered during the drilling and installation of closed loop geothermal boreholes. Each of following geologic hazards will require mitigation if present or anticipated while drilling and/or installing closed loop geothermal boreholes.

- Natural Gas: Encountering pressurized natural gas while drilling can cause blowouts which may damage equipment, injure workers, and cause fires. Natural gas can also channelize cements and grouts, creating pathways for gas and other pollutants to migrate along the borehole and potentially into aquifers.
- Oil: The presence of oil while drilling poses the risk of aquifer contamination if not properly mitigated.
- Faults & Fractures: Open faults and fractures can create pathways that lead to the loss of drilling fluids and grout. They can also be a conduit for pollutants to enter a borehole from the surrounding rock units.
- Void Spaces or Karst: Drilling in areas with karst features or other void spaces increases the risk for loss of circulation and grout. Encountering large voids can cause injury to drillers and/or damage to rig equipment. New void spaces may be created by the circulation of drilling fluids in evaporite units.
- Groundwater Chemistry: The effectiveness of bentonite, a main ingredient in most thermal grouts, can be greatly affected by the presence of brine or saline water. Steps must be taken during the mixing of the grout if saline groundwater is present. Other possible components of groundwater (such as sulfur or high alkalinity) may also have a negative influence on the effectiveness of grouting materials.
- Hydrogen Sulfide: Naturally occurring hydrogen sulfide (H_2S) gas has been documented at numerous drill sites in New York State. H_2S poses numerous health risks depending on concentration and the duration of exposure. It causes teary eyes, dizziness, nausea, headaches, fatigue, and can be fatal with prolonged or acute exposure, if concentrations are high enough.
- Artesian Conditions: The presence of pressurized groundwater can hinder drilling operations and cause difficulties when attempting to cement and/or grout the closed loop geothermal borehole. The introduction of additional fluid can dilute grout and cause the settling of grout additives such as graphite or sand.
    - *The Closed Loop dGEIS will include a more in-depth description of potential drilling hazards and the risks associated with each based on program knowledge, literature review, and stakeholder input.*

3.3. Hazards by Location

As discussed in Section 3.1 of this scope, the geology of New York State is highly variable. This inconsistency causes the potential hazards associated with drilling deeper than 500 feet to change depending on location.

- *The Closed Loop dGEIS will discuss the geographic and geologic distribution of the hazards in Section 3.2 with reference to the regions established in Section 3.1.*

4. Potential Environmental Impacts

Drilling and installation of closed loop geothermal boreholes may have temporary and localized noise, visual, and air quality impacts. There may also be local impacts to water resources, ecosystems, and wildlife. Many of these impacts are short-term or temporary, occurring only during the active drilling, installation, and decommissioning phases of geothermal energy development. Potential mitigation measures for each of these environmental impacts are discussed below and in Section 6 of this scope.

The Closed Loop dGEIS will evaluate the potential environmental impacts associated with the drilling, installation, and decommissioning of the closed loop geothermal boreholes themselves and will not evaluate the impacts of anything beyond the boreholes, such as the heat pump system or any associated components. As discussed in Section 1.4, larger-scale projects may require additional permits unrelated to ECL Article 23, potentially involving a project-specific SEQR assessment to evaluate the aspects and environmental impacts of the project that are not related to the permitting, drilling, or decommissioning of closed loop geothermal boreholes and for which DEC anticipates being an involved agency.

4.1. Noise

4.1.1. Temporary, Short-Term Noise Impacts

Noise is defined as any loud, discordant, or disagreeable sound or sounds.[22] Noise impacts are dependent on several site-specific factors, including time of day, the duration of the sound, and the distance from the source(s) of sound to the receptors, surrounding terrain, ambient sound level.

The primary source of noise during the installation of a closed loop geothermal borehole results from drilling rig operations. Other potential sources of noise during site preparation and drilling include generators supplying power to the rig, electric motors, air compressors, and pumps; the operation of pump trucks, backhoes, tractors, and cement mixers; and truck traffic. It is important to note that the duration of noise impacts from drilling will be dependent on the number of boreholes to be drilled, the target depth of the boreholes, the construction standards required of each borehole, and any concurrent drilling operations at multi-borehole projects. A smaller-scale geothermal project requiring fewer boreholes is likely to have noise impacts of shorter duration than those associated with larger-scale projects.

If there are sensitive receptors near permitted activities, it may be necessary to avoid, minimize or mitigate noise impacts by utilizing techniques such as modifying site layouts and installing natural or manufactured barriers, depending on the duration of the drilling activity. Furthermore, it may be necessary to restrict drilling and construction activities to the least sensitive times of the day and to keep local regulators and neighbors informed about project activity.

[22] NYSDEC, Division of Environmental Permits. 2000. DEP- 00-1: Assessing and Mitigating Noise Impacts.

- *The Closed Loop dGEIS will discuss potential sources of noise during the drilling, installation, and decommissioning of closed loop geothermal boreholes and closed loop stratigraphic test wells and will evaluate the circumstances under which avoidance, minimization or mitigation measures may be necessary based on program knowledge and stakeholder input.*

4.1.2. Longer-Term Noise Impacts

DEC does not expect that long-term noise impacts will be associated with closed loop geothermal borehole installations after completion. When closed loop boreholes are operated in the GSHP system, they do not generate sound independently of the heat pump and associated components. Preliminary review indicates that the sound generated from a GSHP typically ranges from 40 to 42 decibels, like that of a household refrigerator. While borehole maintenance may be required, the resulting actions are short-term and generate minimal noise. Similarly, decommissioning activities may generate short-term, temporary noise, which will cease once the GSHP system and boreholes are fully decommissioned. As such, long-term noise impacts will not be subject to further study in the dGEIS.

4.2. Visual Impacts

Like drilling activities discussed in the 1992 GEIS,[23] visual impacts from closed loop geothermal drilling and completion activities are primarily minor and short-term. As with noise, the presence of a drilling rig during borehole construction has the greatest visual impact of closed loop geothermal systems. Rig masts can vary considerably in height and lighting may be required for safety if drilling operations cannot be limited to daylight hours.

Visual impacts vary based on distance to the viewer and other factors such as surrounding building density, topography, and vegetation. Closed loop geothermal drilling is expected to occur in residential, commercial, and industrial settings. As a result, it may require site-specific review or mitigation such as low intensity lighting or landscaping of the drill site for larger, multi-borehole projects.

Site-specific visual assessment and mitigation may also be required for geothermal projects, depending on the scope and duration of drilling, if proposed within the viewshed of any natural landforms, buildings, or monuments formally designated by local, State, or Federal government as an aesthetic resource.

Following completion, no short- or longer- term visual impacts are anticipated as closed loop boreholes are installed below ground level. The GSHP and its components may have longer-term visual impacts depending on the size and location of the GSHP. However, the heat pump itself and the associated interior distribution piping within any building is outside of the scope of the rulemaking and as such, long-term visual impacts will not be covered in the Closed Loop dGEIS.

- *The Closed Loop dGEIS will discuss short-term visual impacts that may be present during each phase of construction for closed loop geothermal boreholes and available mitigation measures that may be employed and will be based on program knowledge, and stakeholder input.*

[23] NYSDEC. 1992 GEIS on the Oil, Gas and Solution Mining Regulatory Program.

4.3. Air Quality

DEC expects that the development and widespread utilization of geothermal energy will ultimately improve air quality and reduce GHG emissions as hydrocarbon-based energy is phased out. The primary potential air contaminants attributable to drilling geothermal boreholes are airborne dust from site construction activities and truck traffic, and GHG emissions from sources such as the drill rig used to drill the borehole and construction equipment used for site preparation.

4.3.1. Airborne Dust

The impacts of airborne dust during drilling operations are short-term and of limited areal extent, like noise and visual impacts. Larger-scale projects may require more soil disturbance and open space from which dust particles can become airborne, posing a potential threat to human health and the environment. Wind can also transport dust off site and impact nearby waterbodies due to direct deposition. Without proper mitigation, dust from larger project sites may increase the levels of particulate matter in surrounding areas, which can contribute to respiratory health problems and inhospitable working environments.[24]

- *The Closed Loop dGEIS will discuss the potential air quality impacts related to closed loop geothermal drilling and available mitigation measures to control sources of airborne contamination such as dust. This discussion will be based on program knowledge and review of State and/or Federal regulatory programs.*

4.3.2. GHG emissions

Heavy equipment, generators, drill rigs, and passenger vehicles related to the drilling and decommissioning of geothermal boreholes create GHG emissions, including carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), during the fuel combustion process. Although GHG emissions are produced during the drilling process, the drilling phase is short-term and temporary in nature. Following completion of the boreholes, no long-term sources of GHG emissions are anticipated. Over time, a net reduction in GHG emissions will be achieved as a result of the installation and use of a GSHP system as compared to the GHG emissions that would result from conventional heating ventilation and air conditioning.

- *The Closed Loop dGEIS will evaluate the GHG emissions associated with the drilling, operation, and decommissioning of closed loop geothermal boreholes and closed loop stratigraphic test wells based on program knowledge, literature review, and stakeholder input.*

4.4. Water Resources

Protection of New York's diverse water resources is a priority of DEC and the ECL Article 23 regulatory program. DEC is authorized by statute[25] to regulate closed loop geothermal boreholes and closed loop stratigraphic test wells for the purposes of protecting public health and safety in

[24] EPA. 2021. Stormwater Best Management Practice Dust Control.

[25] Environmental Conservation Law (ECL) § 23-0305(15).

addition to natural resources and the environment. This includes preventing the pollution of fresh water supplies during drilling and installation, operation, and decommissioning.

4.4.1. Groundwater Quality

The drilling of a borehole creates a pathway in the subsurface along which fluids such as water, oil, and brine, as well as other contaminants like natural gas, can migrate between geologic strata if not properly isolated. Drilling may also cause potential short-term turbidity in nearby water wells; however, this is temporary in nature and the turbidity should clear shortly after borehole drilling is completed. Drilling practices such as the use of drilling mud in specific situations can temporarily seal the borehole walls to prevent intrusion while actively drilling.[26] Standard casing and cementing practices may be required to ensure that freshwater aquifers are sealed behind cemented steel casing before the borehole is drilled deeper.

From an environmental standpoint, the primary purpose of cement and grout is to seal the borehole, preventing the migration of fluids and contaminants from one stratigraphic layer to another. It is important that the correct cement and grout components are chosen, not only with respect to the efficiency of the geothermal system, but also with attention to subsurface conditions to ensure the integrity of its sealing capabilities. Additives may be mixed and sealed into the cement or grout within the borehole in order to to mitigate the presence of saline groundwater, void space, evaporites, sulfur, high or low pH, or increase shear strength in structurally active areas.

Groundwater contamination can also be caused by surface contaminants seeping into the groundwater. Although different situations may call for different containment methods, DEC will design regulations to help ensure that drilling and waste fluids containing pollutants are properly contained to prevent groundwater contamination from surface seepage.

- *The Closed Loop dGEIS will evaluate the risks to groundwater quality associated with drilling activities and consider the mitigation measures such as casing requirements that DEC may require. The evaluation and resulting mitigation measures will be based on program knowledge, review of relevant industry standards, and stakeholder input.*

4.4.2. Surface Water Quality

The drilling and installation of closed loop boreholes has the potential to affect nearby surface waters. Erosion and sedimentation that occurs during site preparation and drilling phase may result in rock dust and soil deposition into nearby surface waters due to heavy wind or rain events. Drilling fluids, brines, and cuttings must be properly contained and disposed of to ensure they do not impact local waterbodies. The reclamation of drill sites must also be performed in a manner that does not affect surface water quality.

- *The Closed Loop dGEIS will assess potential impacts to surface water quality during drilling activities, describe existing mitigation required, when applicable, under the State*

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[26] Drilling mud is usually a water-based clay mixture that is used to carry rock cuttings to the surface and to lubricate and cool the drill bit during drilling. As described in the 1992 GEIS on the Oil, Gas and Solution Mining Regulatory Program, most wells in New York are drilling on air and drilling mud is not typically used, except when drilling a surface casing hole through thick, shallow gravel deposits, or when high formation pressures or volumes are encountered in the subsurface.

Pollution Discharge Elimination System Construction General Permit, and identify possible mitigation strategies and best management practices such as setbacks and fluid containment. This will be based on program knowledge, review of relevant industry standards, and stakeholder input.

4.4.3. Water Withdrawals

Water may be necessary for drilling operations and can be obtained via purchase from municipalities, groundwater withdrawals, or withdrawals from surface water bodies away from the site. With respect to withdrawal from surface water bodies such as rivers and streams, equipment or structures such as standpipes may require permits under Article 15 of the ECL. In addition, water quality standards established by state regulations prohibit any alteration in flow that would impair a fresh surface waterbody's designated best use. The primary concern regarding groundwater withdrawal is aquifer depletion that could affect other uses. Larger-scale projects involving multiple boreholes are more likely to require greater quantities of water than small-scale or single borehole projects and are therefore more likely to require water withdrawal permits.

- *The Closed Loop dGEIS will evaluate whether geothermal drilling activities may require the withdrawal of local water resources, the potential scale of such withdrawals, and will summarize the existing regulatory programs that have jurisdiction over water withdrawals, based on program knowledge, review of State regulatory programs, and stakeholder input.*

4.5. Ecosystems and Wildlife

DEC expects that most impacts on ecosystems and wildlife from activities related to closed loop geothermal drilling are short-term or temporary in nature. Activities such as site preparation, access road construction, and drilling may result in minor habitat disturbance through, for example, changes in traffic, noise, and lighting, which may directly impact wildlife. Additionally, habitats and species may also be affected by potential pollution from the release of drilling fluids or subsurface fluids such as brine, water, oil, or gas. After drilling and reclamation are complete, closed loop geothermal boreholes often do not have a surface expression and therefore do not create surface impacts. Further, decommissioning activities would likely not require heavy equipment or cause intense habitat disturbances.

Small-scale projects are often drilled in connection to a building where the land has already been developed, such as existing or planned parking lots, building foundations, or residential backyards. These projects would have minimal effects on ecosystems and wildlife as they do not involve additional land disturbance other than the setup of a rig and associated equipment. Larger-scale projects may require additional consideration for habitat disturbances, as more area is needed to drill tens, or in some instances, hundreds of boreholes.

- *The Closed Loop dGEIS will describe the potential impacts closed loop geothermal drilling activities may have on ecosystems and wildlife, and explore mitigation strategies, as appropriate, based on program knowledge, State and/or Federal regulatory programs, and stakeholder input.*

4.6. Invasive Species

Machinery and equipment used to remove vegetation and soil at project sites may come in contact with invasive plant species that exist at a site and inadvertently transfer those species' seeds, roots, or other viable parts via tires, treads, tracks, or buckets to another location on site, to a separate project site, or to any location in between. For smaller-scale projects and projects in urban and suburban locations, where little vegetation or soil will be removed, the transfer of invasive species is unlikely. For larger-scale projects that involve the clearing of land and construction of access roads, invasive species populations may have the potential to be introduced and transferred.

- *The Closed Loop dGEIS will discuss the potential options available to prevent or otherwise control the spread of invasive species during the drilling of closed loop geothermal boreholes at larger-scale project sites, based on program knowledge, review of State and/or Federal regulatory programs, and stakeholder input.*

4.7. Freshwater Wetlands

Freshwater wetlands include diverse habitats such as mossy bogs, cattail marshes, and swamps of mature trees. They are all characterized, however, by the presence of shallow waters or waterlogged soils that support distinctive communities of aquatic or water-tolerant plants. Viewed as a group, wetlands perform many essential functions.

DEC regulates activities impacting DEC regulatory wetlands under ECL Article 24, as well as any excavation or fill activities in wetlands connected to navigable waters, regardless of size, in accordance with ECL Article 15, Title 5. The construction of closed loop geothermal sites and access roads in wetlands may result in the destruction of vegetation, changes in landscape and water levels, and loss of plant and animal habitat. These alterations have the potential to adversely affect the ecological balance of wetlands and the benefits they provide.

Although DEC does not anticipate that many closed loop geothermal borehole or closed loop stratigraphic test well projects will be proposed within freshwater wetlands, DEC staff will determine whether the proposed borehole(s) or wells will be located in or adjacent to a freshwater wetland during the permit application review process. Under the Freshwater Wetlands Act, it is State policy to preserve, protect, and conserve freshwater wetlands and the benefits derived therefrom.[27] Therefore, a Freshwater Wetlands Permit[28] is required for any activity within a wetland.

- *The Closed Loop dGEIS will summarize the Freshwater Wetlands Permit(s) needed for projects located within State or federally protected wetlands. These permits will be issued by DEC's Division of Environmental Permits and/or the United States Army Corps of Engineers, respectively. The summary will be based on program knowledge, review of State and/or Federal regulatory programs, and stakeholder input.*

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[27] Environmental Conservation Law (ECL) § 24-0103.

[28] 6 NYCRR Parts 663 – 665.

4.8. Future Physical Climate Risks

In 2014, the Community Risk and Resiliency Act[29] (CRRA) was signed to strengthen New York's resilience to rising sea levels, storm surge, and flooding. Section 9 of the CLCPA of 2019 amended CRRA to require that applicants[30] demonstrate consideration of future physical climate risk due to climate change during project siting and design, and authorized DEC to require mitigation of significant risks to public infrastructure and/or services, private property not owned by the applicant, and adverse impacts to disadvantaged communities and/or natural resources in the vicinity of a project in the course of its review of permit applications. DEC's Commissioner's Policy 49: Climate Change and DEC Action (CP-49)[31] provides direction to DEC staff regarding responsibilities related to incorporating climate change considerations and outlines procedures for compliance with the provisions of CRRA.

- *The Closed Loop dGEIS will examine whether any additional protections or environmental reviews are necessary to prevent damage from future physical climate risks such as storm surge, sea level rise, and flooding based on site location of proposed closed loop geothermal projects. These factors will be evaluated using program knowledge and review of State regulatory programs.*

4.8.1. Flood Risk Management Areas

Floodplains are low-lying lands next to rivers and streams prone to flooding events. These include areas with a one-percent annual chance of flooding, which are more commonly known as 100-year floodplains, areas with a 0.2-percent annual chance of flooding, which are more commonly known as 500-year floodplains, and projected future flood-prone areas,[32] as well as sea level rise and storm surge in tidal riverine systems. When floodplains are altered, the ability of floodplains to absorb floodwaters and reduce risk from a flood is diminished. Most municipalities in New York State have flood damage prevention laws intended to reduce the risk of flooding and to increase community resilience.

- *The Closed Loop dGEIS will examine whether any additional protections or environmental reviews are needed for sites in floodplains where closed loop geothermal boreholes are proposed based on program knowledge and review of State and/or Federal regulatory programs.*

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[29] NYSS. 2014. CRRA. Ch. 355.

[30] This requirement is specific to applicants for major projects in programs regulated under the Uniform Procedures Action (UPA) (ECL Article 70). The ECL Article 23 regulatory program is not administered under UPA; however, CRRA also amended ECL § 23-0305 to add subdivision 8-a, which requires DEC to include consideration of future physical climate risk due to sea level rise, storm surges, and flooding to permits issued pursuant to Title 5 of Article 23.

[31] NYSDEC. 2010. Commissioner's Policy CP-49: Climate Change and DEC Action.

[32] Future flood-prone areas are determined by a climate-informed science approach that considers anticipated increases in extreme precipitation events. For additional information regarding using a climate-informed science approach to determine projected future flood-prone areas, refer to the New York State Flood Risk Management Guidance for Implementation of the Community Risk and Resiliency Act.

4.8.2. Sea Level Rise and Storm Surge

Sea level rise and increasing storm surge elevations present a serious hazard to coastal resources. As required by CRRA, DEC established science-based sea level rise projections in 6 NYCRR Part 490[33] for three regions, including Long Island, New York City/Lower Hudson, and Mid-Hudson.

- *The Closed Loop dGEIS will examine whether any additional protections or environmental reviews are necessary in coastal areas threatened by sea level rise and increasing storm surge elevations based on program knowledge and review of relevant state regulations.*

4.9. Road Use

The ECL specifies that local governments retain jurisdiction over local roads. Local governments have broad authority under Title 8 of New York State's Vehicle and Traffic Law[34] to regulate road use in their jurisdictions. Therefore, early coordination between operators and local governments is strongly encouraged.

Increased traffic associated with closed loop geothermal projects will be limited to drilling, installation, and grouting activities. Vehicles such as drilling rigs, pump trucks, and flatbed trucks for transportation of materials will require use of local roadways to reach borehole locations. Drilling crew members may also use local roads to access sites. In addition, the drilling of closed loop geothermal boreholes located in urban areas may necessitate temporary closure or partial closure of roads to accommodate the drill rig and any associated equipment. Except for large-scale multi-borehole geothermal fields, DEC does not expect that the increased traffic associated with the drilling and installation of closed loop geothermal boreholes or closed loop stratigraphic test wells will have a significant effect on roadway traffic or deterioration. Any impacts resulting from larger-scale projects may be addressed by the associated site-specific SEQR reviews for the projects. Decommissioning of closed loop geothermal boreholes or closed loop stratigraphic test wells is likely to have a much smaller effect on roadway traffic, especially in comparison to the drilling and installation phases. As such, road use will not be discussed further in the Closed Loop dGEIS.

4.10. Cumulative Impacts

Cumulative impacts occur when multiple actions affect or have the potential to adversely affect the same resource(s).[35] These impacts can result from the incremental impact of an action when added to other past, present, and reasonably foreseeable actions regardless of which agency or person undertakes such other actions. Cumulative impacts can also result from individually minor, but collectively significant, actions taking place over a length of time.

Geothermal energy is a renewable resource that can be implemented at scale with few, if any, technical limitations restricting the number of GSHP systems installed throughout New York State.

[33] 6 NYCRR Part 490.

[34] Laws of New York, Vehicle and Traffic Law. Title 8 § 1600-1706.

[35] NYSDEC. 2020. The SEQR Handbook, Fourth Edition. pg. 80.

GSHP projects may range in size from an individual borehole to a field containing hundreds of boreholes. DEC expects that closed loop geothermal development is likely to expand exponentially due to improvements in geothermal technologies.

Changes in the market and other economic conditions will have an impact on how quickly geothermal energy is adopted and projects advance. However, the Final Scoping Plan issued by the Climate Action Council emphasizes that energy efficiency and managed electrification in buildings will be critical to meet New York State's GHG emissions limit under CLCPA. The Final Scoping Plan states that "all scenarios modeled in the CLCPA integration analysis include rapid adoption of high efficiency heat pumps so that one to two million energy efficient homes use heat pumps by 2030, and by 2050, the large majority of buildings statewide use electric heat pumps for heating, cooling, and hot water."[36,37] To achieve this rapid growth, New York State[38] and Federal[39] tax credit incentives have been established in addition to rebates from New York's utility providers to promote the construction of electric heat pump systems, with priorities afforded to disadvantaged communities.

DEC anticipates an increased potential for cumulative impacts on larger scale projects due to the increased number of boreholes drilled and the longer duration of construction activities; however, these are short-term impacts as described throughout Section 4. Once drilling operations are completed and sites are fully reclaimed and revegetated or repurposed (e.g., parking lot), operating borefields consist of tightly spaced, buried, or hidden boreholes with underground piping leading to a GSHP. Placement of the GSHP and associated interior distribution piping within any building is outside of the scope of DEC's authority under ECL Article 23, but should follow manufacturer's specifications and recommendations.

If left unregulated, the drilling of closed loop geothermal boreholes could potentially have adverse cumulative impacts on groundwater resources. However, DEC expects that the proposed regulations specific to closed loop geothermal will provide protection of such resources and mitigate any potential adverse cumulative impacts, and therefore cumulative impacts will not be addressed further in the Closed Loop dGEIS.

4.11. Community Character

The NYS Legislature has defined "environment" to include, among other things, "…existing patterns of population concentration or growth, and existing community or neighborhood character."[40] Community character is related both to the environment of a community, and the way the population functions within and perceives their community.[41] DEC does not expect

[36] NYSCAC. New York State Climate Action Council Scoping Plan. Ch. 12: Buildings, pg. 176.

[37] The CLCPA integration analysis referenced in the Final Scoping Plan included the adoption of both air-source and ground-source heat pumps to achieve the one to two million energy efficient home total.

[38] NYDTF. https://www.tax.ny.gov/pit/credits/geothermal-energy-system-credit.htm.

[39] NYSIRS. Form 5695: Residential Energy Credits.

[40] ECL § 8-0105(6)

[41] NYSDEC. 2020. The SEQR Handbook, Fourth Edition. pg. 84.

adverse impacts to community character from geothermal energy development. The scale of GSHP systems proposed range from single closed loop geothermal borehole projects to larger-scale projects containing hundreds of boreholes. Locations could involve remote rural or residential communities, industrial districts, suburban, and densely populated urban areas.

Short-term impacts to the community will primarily occur during the drilling and installation phases of construction, as described throughout Section 4, and are temporary, nuisance-type impacts. Minor to moderate temporary impacts that may be experienced during construction will result in a net positive impact resulting from project completion. DEC expects that a majority of these impacts will be identified, avoided, minimized or mitigated during the planning and permitting phase before any construction or site preparation occurs. None of these types of impacts rises to the level of an impact on community character.

Widespread geothermal development is expected to positively impact communities by providing an efficient renewable energy source capable of meeting building sector heating and cooling demands. Geothermal development will also contribute to an increase in energy independence and environmental sustainability attributed to the reduced reliance on conventional carbon-based fuels. As such, community character will not be addressed further in the Closed Loop dGEIS.

4.12. Disadvantaged Communities and Potential Environmental Justice Areas

Disadvantaged communities (DACs) are defined in the CLCPA as "communities that bear burdens of negative public health effects, environmental pollution, impacts of climate change, and possess socioeconomic criteria, or comprise high concentrations of low- and moderate- income households."[42] DACs have been identified based on a list of criteria compiled by the Climate Justice Working Group and finalized in March of 2023. Section 7(3) of the CLCPA requires that, in making administrative decisions such as permitting actions, state agencies must not disproportionately burden DACs and must prioritize the reduction of GHG and co-pollutant emissions in DACs. DEC's Division of Environmental Permits Program Policy DEP 24-1, Permitting and Disadvantaged Communities Under the CLCPA (DEP 24-1)[43] provides direction to DEC staff when reviewing certain permit applications associated with sources and activities in or likely to affect a DAC which result in GHGs or co-pollutant emissions regulated pursuant to ECL Article 75.[44]

Potential environmental justice areas (PEJAs), as defined in DEC Commissioner's Policy 29, Environmental Justice and Permitting (CP-29),[45] are minority or low-income communities that may bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of Federal, State, local, and

[42] Environmental Conservation Law (ECL) § 75, Climate Change.

[43] NYSDEC, Division of Environmental Permits, 2024. DEP 24-01: Permitting and Disadvantaged Communities Under the Climate Leadership and Community Protection Act.

[44] DEP 24-1 does not directly apply to ECL Article 23 permits, as ECL Article 23 is not administered under the Uniform Procedures Act and is not one of the programs specified in Section V.1. Applicability, of the policy. The Division of Mineral Resources intends to comply with the processes and procedures outlined in DEP 24-1 however, in order to ensure compliance with the requirements of Section 7(3) of CLCPA.

[45] NYSDEC. 2003. Commissioner's Policy 29: Environmental Justice and Permitting.

tribal programs and policies. Where DEC is lead agency under SEQR, projects located within PEJAs warrant enhanced public participation to ensure that citizens are informed about and involved in the review of proposed actions when any significant adverse environmental impacts on the PEJA may result from the project.

DACs and PEJAs are defined by a host of criteria, some of which are overlapping and some of which are distinct. As a result, some PEJAs are also identified as DACs, while others are not. Refer to DECinfo Locator[46] on DEC's website to view designated DACs and PEJAs.

Environmental impacts associated with the drilling and installation of closed loop geothermal boreholes are anticipated to be transient and temporary in nature and therefore di minimis. As described above in Sections 4.10 and 4.11, the long-term impacts from the addition of geothermal energy development to communities are anticipated to be generally positive in nature, resulting in a net reduction of GHG and co-pollutant emissions. Therefore, DACs and PEJAs will not be further addressed in the Closed Loop dGEIS.

4.13. Areas of Historic, Architectural, Archeological, and Cultural Significance

The New York State Historic Preservation Act of 1980[47] requires that all State agencies prevent adverse impacts on New York's historic and archaeological resources. To ensure that drilling activities avoid disturbing areas of historic or archaeological significance, DEC staff review every permit application using the Geographic Information System ("GIS") maps provided by the State Office of Parks, Recreation and Historic Preservations ("OPRHP") website. These maps show sites listed on the State or Federal registers of historic places and the approximate locations of archaeologically sensitive areas.

If the site of a proposed closed loop geothermal borehole or closed loop stratigraphic test well is within a designated area of significance, the applicant must consult with OPRHP. The applicant may need to conduct a Phase 1 survey for all portions of the project that will involve ground disturbance and provide the completed survey to OPRHP for review. OPRHP interacts directly with the applicant, and DEC cannot issue a well permit for any site location that requires OPRHP involvement until OPRHP has made a determination.

- *The Closed Loop dGEIS will discuss the coordination required between an applicant, DEC, and OPRHP if the proposed location of a closed loop geothermal borehole is in an area of historic, architectural, archeological, or cultural significance.*

5. Permit Process and Regulatory Coordination

Article 23 of the Environmental Conservation Law grants DEC the authority to regulate closed loop geothermal boreholes and closed loop stratigraphic test wells drilled deeper than 500 feet throughout New York State. To carry out provisions of the law, DEC will be evaluating the potential impacts associated with the drilling, operation, and decommissioning of these closed loop boreholes. DEC is the lead agency in regulating closed loop geothermal boreholes and closed loop stratigraphic test wells for the purposes of SEQR compliance.

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[46] NYSDEC. DECinfo Locator.

[47] NYSOPRHP. NYS Historic Preservation Act. Section 14.09 Part 428.

- *The Closed Loop dGEIS will describe the permitting process including the application requirements, setbacks and surface restrictions, borehole design and construction, operating practices, decommissioning, and reporting requirements.*

5.1. Application Materials

Closed Loop Geothermal Boreholes - An application for permit to drill a closed loop geothermal borehole greater than 500 feet deep will be considered an application for either a single closed loop geothermal borehole or a project encompassing multiple closed loop boreholes sharing a larger common plan of development.

Closed Loop Stratigraphic Test Wells - An application to drill a closed loop stratigraphic test well will continue to be considered an application for a permit to drill only a single closed loop stratigraphic test well that is not part of a larger common plan of development.

Prior to applying for a permit to drill, DEC is proposing to have applicants file an Organizational Report Form and a Qualified Contractor Attestation form with the Division of Mineral Resources' office in Albany, New York. Financial security may not be required for closed loop geothermal boreholes or closed loop stratigraphic test wells.

- *The Closed Loop dGEIS will discuss qualified contractor accreditation.*
- *The Closed Loop dGEIS will discuss the construction of closed loop boreholes and the reasons financial security may not be required.*

Application materials for both closed loop geothermal boreholes and closed loop stratigraphic test wells are proposed to include a program specific Environmental Review Analysis (ERA) as discussed in Section 1.4 of this document. In addition to the application and ERA, applicants should provide the proposed coordinates of each borehole or well location, the affected addresses and tax parcel ID numbers, a dimensioned site diagram, and a work plan. For closed loop stratigraphic test wells, a permit fee as set forth in Environmental Conservation Law § 23-1903 will still be required. A new application fee structure in line with other states will be evaluated for closed loop geothermal boreholes.

- *The Closed Loop dGEIS will discuss the application process and evaluate how the information received in the application materials will help mitigate the potential impacts of drilling closed loop geothermal boreholes and closed loop stratigraphic test wells.*
- *The Closed Loop dGEIS will discuss the application fee structure for closed loop geothermal boreholes.*

5.2. Coordination with other DEC Divisions and Outside Agencies

The Division of Mineral Resources regulates the drilling of closed loop geothermal boreholes and closed loop stratigraphic test wells under Article 23 of the Environmental Conservation Law. To mitigate the potential impacts of closed loop geothermal drilling, Division of Mineral Resources staff will coordinate with other DEC Divisions and various outside agencies, including the New York City Department of Environmental Protection (NYC DEP), as necessary, during the permit application review process. NYC DEP promulgated regulations under NYC Title 15, Chapter 57[48] to protect water tunnel infrastructure within the five boroughs from any potential damage that could be caused by drilling or other excavation operations. Division of Mineral Resources staff have coordinated with NYC DEP in the past and will continue to do so when reviewing closed loop geothermal permit applications in areas with NYC DEP jurisdiction.

- *The Closed Loop dGEIS will provide a summary of intraagency coordination involved in the regulation of closed loop geothermal boreholes and closed loop stratigraphic test wells in New York State.*
- *The Closed Loop dGEIS will review the extent of necessary additional coordination with outside agencies such as Department of Public Service and NYC DEP.*

5.3. Public and Local Government Participation

ECL Article 23 provides that DEC's Oil, Gas and Solution Mining Law supersedes all local laws or ordinances relating to the regulation of the geothermal industry with respect to boreholes and wells drilled deeper than 500 feet, except for local government jurisdiction over local roads or the right to collect real property taxes. Likewise, ECL § 23-1901(2) provides for supersedure of all other laws enacted by local governments or agencies concerning the imposition of a fee on activities regulated by Article 23. These provisions of the law were enacted to address legislative concerns that local government regulation would result in a patchwork of conflicting local ordinances regulating the geothermal industry.

When closed loop geothermal boreholes are part of larger construction projects however (e.g., the boreholes will be drilled in the footprint of a building to be constructed), local governments may have authority over the larger construction project and additional review under SEQR may be required. Therefore, the Closed Loop dGEIS will evaluate opportunities for local government and public input in such instances.

- *The Closed Loop dGEIS will examine the need for coordination between State and local levels of government, where appropriate, relating to the drilling, operating, and decommissioning of closed loop geothermal boreholes and closed loop stratigraphic test wells based on program knowledge.*

6. Proposed Mitigation Measures to Prevent Potential Adverse Environmental Impacts

DEC proposes means to minimize, avoid or mitigate impacts, as described below in Sections 6.1, 6.2 and 6.3. They will be evaluated in the GEIS. Mitigation of potential environmental impacts will be accomplished through the proposed regulations for closed loop geothermal boreholes and closed loop stratigraphic test wells drilled deeper than 500 feet. The regulatory requirements under consideration will address the topics discussed below; however, they may not represent the full scope of mitigation measures that will ultimately be implemented.

[48] NYCDEP. 2019. Title 15, Ch. 57: Rules Concerning Drilling and Excavation.

6.1. Permit Application Review

Application review is a critical element of the permitting process and helps identify any potential adverse impacts associated with permitted activities and adequately mitigate them. A thorough application review process will ensure boreholes are sited and constructed in a manner that is appropriate for each proposed site location.

The following mitigation measures and procedures relevant to application review will be evaluated in the Closed Loop dGEIS:

- *Required Application Materials: These documents will provide DEC staff with sufficient information to perform a thorough permit application review.*
- *Borehole Siting: Regulatory setback and surface restrictions will mitigate the risks to sensitive environmental receptors, prevent contamination of potable aquifers, and protect buried utilities from damage.*
- *Design and Construction Standards: Casing should be designed to protect primary and principal aquifers, to ensure borehole integrity, and to prevent the migration of subsurface hydrocarbons, fluids, and other gases. In addition, grouting material used to seal the tubing in place in the borehole should be mixed according to site-specific conditions to ensure an adequate seal and to prevent grout contamination from brine or other subsurface fluids.*

6.2. Drilling Operations

As discussed in Section 2.1, the drilling phase will require sufficient environmental oversight to prevent pollution and to protect public health and safety.

The need for the following mitigation measures and procedures for the drilling phase of closed loop geothermal borehole development will be evaluated in the Closed Loop dGEIS:

- *Notifications and Reporting Requirements: Notifications ensure that all parties have knowledge of the permitted drilling operations and allow DEC staff to plan for inspections. The submittal of reports allows DEC staff to keep up-to-date records for future permitting and application review and also ensures the information in the reports will be publicly available.*
- *Marking Locations of Subsurface Components: Marking the locations of closed loop geothermal boreholes with tape detectable by a magnetic locator prevents future development or construction from damaging installed borehole components.*

6.3. Ongoing Site Operations

Once the installation of the closed loop geothermal borehole(s) is completed and the GSHP system is operational, DEC does not anticipate that ongoing or routine maintenance of the borehole(s) will be required. Therefore, it may not be necessary to extend regulatory oversight over the borehole(s) to the operational phase, beyond the reporting of any non-routine incident (e.g., heat transfer fluid leak).

- *The Closed Loop dGEIS will discuss the operational phase of closed loop geothermal boreholes as a component of the GSHP system and the potential for environmental impacts.*

6.4. Fluid/Waste Disposal

Fluids and cuttings are handled at the project site during drilling and installation of closed loop geothermal boreholes and closed loop stratigraphic test wells. Appropriate fluid handling is coordinated with and regulated by other DEC programs, as discussed in Section 5.2.

- *The Closed Loop dGEIS will summarize the existing requirements regarding the handling and disposal of wastes generated during the drilling, installation, and decommissioning of closed loop geothermal boreholes.*

6.5. Decommissioning

A closed loop geothermal borehole or closed loop stratigraphic test well must be properly decommissioned once it is no longer able to function for its intended, permitted use. Decommissioning involves flushing the heat transfer fluid from the loops for proper disposal and properly sealing the loops grouted into the borehole to eliminate any subsurface conduits. This is necessary to prevent the borehole from posing a threat to public safety or the environment.

The following mitigation measures and decommissioning procedures will be evaluated in the Closed Loop dGEIS:

- *Notification and Reporting Requirements: Similar to the drilling phase, notification and reporting allow DEC to track decommissioning plans and to keep records of borehole status up to date.*

- *Proper Decommissioning Procedures: Proper decommissioning guidelines will ensure the borehole is sealed and will prevent migration of fluids and gas in the subsurface.*

7. Alternative Actions

The goal of analyzing alternatives in a GEIS is to investigate means to avoid or reduce potentially adverse environmental impacts identified by the environmental impact statement.

- *Alternatives to be reviewed by the Closed Loop dGEIS will include a) the no action alternative that would leave closed loop geothermal development unregulated; b) prohibiting geothermal development statewide or in certain areas; c) other alternatives, if any, developed through the scoping process.*

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