APPENDIX D1

RECORD OF DECISION AND SELECTION OF REMEDIES FOR CORRECTIVE ACTION AREA I AND CORRECTIVE ACTION AREA II

I. SELECTION OF REMEDIES

1. In making the Record of Decision and selection of remedies for Corrective Action Area I and Corrective Action Area II, the Agency of Natural Resources (ANR) has reviewed the following documents:

a. Conceptual Site Model (CSM) prepared by Barr Engineering on behalf of Settling Defendant dated February 2017;

b. the revised Comparative Analysis of Corrective Actions for Corrective Action I prepared by Barr Engineering on behalf of Settling Defendant dated April 2017;

c. the June 30, 2017 revision to the CSM by Barr Engineering on behalf of Settling Defendant and a response to ANR comments;

d. Conceptual Site Model Site Investigation Report: Bennington, Vermont prepared by Barr Engineering on behalf of Settling Defendant dated March 2018; and

e. Evaluation of Corrective Action Alternatives: Corrective Action Area II prepared by Barr Engineering on behalf of Settling Defendant dated March 2019.

2. Based on a review of information identified in Paragraph 1, active soil and groundwater remediation of area-wide PFOA, PFHpA, PFNA, PFHxS, and

PFOS within Corrective Action Area I (CAA I) and Corrective Action Area II (CAA II), as identified in Appendix B, is not technically feasible nor cost effective.

3. Based on a review of information identified in Paragraph 1, and subject to the conditions identified herein, the corrective actions selected by the ANR for CAA I and CAA II are:

a. Corrective Action options that eliminate impacted receptors from drinking water with PFOA, PFHpA, PFNA, PFHxS, and PFOS at or above the Vermont Groundwater Enforcement Standard, which is currently 20 ppt.

i. Connect impacted persons with municipal water where technically feasible and cost-effective.

ii. Where connection to municipal line is not technically feasible nor cost-effective, install a replacement drinking water well for impacted residents/businesses, where technically feasible. If a replacement well is determined not technically feasible, then point-of-entry treatment (POET) will be the long-term corrective action option.

b. *Corrective Action options that remediate groundwater and restrict groundwater use.*

i. Monitored natural attenuation. This will require the sampling of monitoring wells and drinking water wells over time. The locations and criteria for monitoring will be provided in a Corrective Action Plan.

ii. Institutional Controls. An institutional control plan or plans are needed to restrict groundwater use and minimize potential exposure to PFOA, PFHpA, PFNA, PFHxS, and PFOS. Institutional control plan(s) shall be submitted as part of a Corrective Action Plan, which shall include the following:

- a proposal to reclassify groundwater for areas that are eligible to be connected to municipal water, including those areas within existing municipal water prior to corrective action being implemented in CAA 1 or CAA II. This proposal, at a minimum, would recommend measures to prohibit the installation of new potable water supply wells, or an equivalent alternative institutional control, within 200 feet of a municipal water line.
- A proposal to reclassify groundwater for all other areas in CAA I and CAA II, that provides recommended well design and installation standards for new or replacement wells. When designing these standards, Settling Defendant shall also provide a cost estimate for implementation of the proposed design and installation standards. The ANR shall take cost to

homeowners into consideration when approving any alternate design and installation standard.

4. The ANR's use of the information identified in Paragraph 1 to reach a remedy decision does not constitute an approval of these documents or models nor does it imply the ANR concurs with their conclusions.

5. The ANR reserves the right to require active remediation/corrective action in localized areas, such as the two former Chemfab facilities.

6. This Remedy Selection is contingent on the ANR's approval of a Corrective Action Plan(s) (CAPs), prior to the implementation of any remedy within CAA I or CAA II.

7. Settling Defendant has submitted a Corrective Action Plan for CAA I, which the ANR approved on June 25, 2018. This Corrective Action Plan included an Institutional Control Plan. The original Corrective Action Plan for CAA I specifically addressed PFOA. Following submission of the Corrective Action Plan for CAA I, ANR issued an emergency rule establishing a combined groundwater standard of 20 ppt for PFOA, PFOS, PFHxS, PFHpA, and PFNA. Accordingly, Settling Defendant shall submit a revised corrective action plan for CAA I that incorporates the new combined standard.

8. A revised Corrective Action Plan, institutional control plan, or both, for Corrective Action Area I may be separately submitted or consolidated with the Corrective Action Plan and institutional control plan for Corrective Action Area II.

II. BASIS FOR THIS DECISION DOCUMENT AND REMEDY SELECTION FOR CAA I

9. Subject to the modifications set forth herein, the basis for decision and remedy as set forth in Section II (Basis for this Decision Document and Remedy Selection for CAA I) in Appendix D of the October 2, 2017 Consent Order are incorporated herein by reference.

a.With respect to the remedy, t he term PFOA is replaced with the terms PFOA, PFHpA, PFNA, PFHxS, and PFOS given corresponding changes to the Consent Order in which this document (Appendix D) is included, and the term perfluorinated compounds (PFCs) is universally replaced with the term Per- and polyfluoroalkyl substances (PFAS), which is now the more commonly accepted term by the science and regulatory community to describe PFOA, PFOS, and other chemicals in this group. With respect to the remedy, the 20 ppt standard is replaced with the regulatory standard(s) for PFOA, PFHpA, PFNA, PFHxS, and PFOS in the Groundwater Protection Rule and Strategy, as may be amended.

b. Paragraph 10(e)(iv) is replaced with the following: "Human direct contact with soil: All soil samples beyond the former Saint-Gobain/Chemfab facility on Water Street were below the Vermont soil screening levels (300 ppb for PFOA) for direct contact." Soil samples below the slab of the former facility and collected after the October 2, 2017 Consent Order had levels just above 300 ppb for PFOA.

III. BASIS FOR CONDITIONAL CONCURRENCE OF COMPARATIVE ANALYSIS OF CORRECTIVE ACTION OPTIONS FOR CAA I

10. Subject to replacement of the term PFOA with the terms PFOA, PFHpA, PFNA, PFHxS, and PFOS as described above, the basis for decision and remedy as set forth in Section III (Basis for Conditional Concurrence of Comparative Analysis of Corrective Action Options for CAA 1) in Appendix D of the October 2, 2017 Consent Order are incorporated herein by reference.

IV. BASIS FOR THIS DECISION DOCUMENT AND REMEDY SELECTION FOR CAA II

11. This Section describes the process that the Agency used to determine that the CSM, as described in the documents specified in Paragraphs 1(a), 1(c), and 1(d) herein, was adequate for making a decision about the remedy or remedies to be implemented within CAA II as shown on Appendix B map. Further, this Section explains how Settling Defendant has met the requirements for site investigation for CAA II as provided in the Vermont Department of Environmental Conservation rule entitled "Investigation and Remediation of Contaminated Properties Rule," effective July 2017 (hereinafter "IROCPR").

12. Site investigation requirements in IROCPR. The IROCPR procedure requires the following to be addressed in a Site Investigation:

a. Identification of contaminants of concern and identification of contaminant sources and potential sources (Contaminant/Source);

b. Description of Physical Setting (including, but not limited to, geology, land use, surficial geology, surface water features, and hydrogeology);

c. The degree and extent of the contamination (Plume Definition);

d. Contaminant fate and transport of the contaminant or contaminants of concern;

e. Identification of all at risk or potentially threatened sensitive receptors (including but not limited to, water supply wells, water supply source projection areas, surface waters, wetlands, direct contact threat, etc.);

f. CSM (a description of site conditions incorporating available site characterization information and data). The CSM is the Site investigation tool that provides context and guidance for further activities, that is, further site investigation, corrective action, or both.

13. Site investigation activities and information to date. The following is a summary of the site investigation/CSM activities that have been performed to date in response to the presence of Per- and polyfluoroalkyl substances (PFAS), including the targeted five PFAS (PFOA, PFHpA, PFNA, PFHxS, and PFOS) found in soil and groundwater in the North Bennington and Bennington area at or above the Vermont Groundwater Enforcement Standard (VGES). The current VGES for the targeted five PFAS is 20 ppt.

a. *PFAS/Source*: The CSM identified some potential sources and pathways for based on information provided by Settling Defendant. This information included facility information and historical records and site

investigation data collected by others, including the Environmental Protection Agency and ANR. Sources of PFAS identified in the CSM include:

i. Emissions of PFAS through stacks at the former Chemfab facility on Water Street (1978-2002) and the former Chemfab facility on Northside Drive (1969-1978). PFAS-containing dispersants were used at both facilities; and

ii. Former disposal facilities, including the Bennington Landfill; other industrial sources; and Wastewater Treatment Plant Sludge.

b. *Physical Setting Description*: The CSM provided a description of physical setting primarily using existing geologic and hydrogeologic data and studies for the region, for the former Chemfab facility located on Water Street in North Bennington, the former Chemfab facility located on Northside Drive in Bennington, and for the Bennington Landfill.

c. *Plume Definition*: The CSM used the following data to assess plume definition of the area-wide contamination as shown by the boundaries of CAA II (and CAA I) on the Appendix B map.

i. Drinking water well results for water samples collected primarily from ANR and their contractor: As of April 1, 2019, over 625 samples from drinking water wells were collected. Approximately 335 samples had PFOA concentrations at or above 20 ppt.

ii. Sediment and surface water results for samples collected by ANR. Seven sediment and ten surface water samples were collected.

Sediment samples ranged from non-detect to 2.4 parts per billion (ppb) PFOA. Surface water levels ranged from non-detect to 79 ppt PFOA.

iii. PFAS analytical results from soil samples collected by Settling Defendant at the facility on Water Street and its surrounding area: Results are provided and summarized in the document titled "Draft Shallow Soil Sampling Report Former Chem Fab Site & Surrounding Areas," dated July 20, 2016. One hundred forty-five (145) soil samples were collected. Results ranged from non-detect to 45 ppb PFOA.

iv. PFAS analytical results from soil samples collected by Settling Defendant during their area-wide investigation: Results are provided and summarized in the document titled "Conceptual Site Model Site Investigation Report: Bennington, Vermont prepared by Barr Engineering dated March 2018." A total of 568 soil samples were collected from 46 shallow soil borings (typically less than 8 feet) and 25 deep soil borings (depths up to 200 feet). These soil samples were analyzed for PFAS and other parameters. PFOA concentrations in the soil samples ranged 0.16 ppb to 130 ppb. A total of 14 shallow monitoring wells, 10 deep monitoring wells, and four bedrock wells were installed. PFOA concentrations ranged from 5 ppt to 850 ppt in shallow monitoring wells, 8 to 240 ppt in the deep monitoring wells, and 0.4 ppt and 180 ppt in the bedrock monitoring wells.

d. *PFAS Fate and Transport*: The CSM provided information about the fate and transport of PFOA and other PFAS based primarily from

literature review (reports and studies at other sites with PFAS and research on the fate and transport of PFAS).

i. Airborne transport is a pathway and airborne deposition is a source for PFAS, including the five targeted compounds (PFOA, PFHpA, PFNA, PFHxS, and PFOS);

ii. PFOA, and the other targeted PFAS (PFHpA, PFNA, PFHxS, and PFOS), are stable and persistent in the environment;

iii. The movement of PFOA, and the other targeted PFAS (PFHpA, PFNA, PFHxS, and PFOS), are slowed through the vadose zone, however, studies vary about the degree of retention in the soil; and

iv. When PFOA, and the other targeted PFAS (PFHpA, PFNA, PFHxS, and PFOS), are present in groundwater, there is some retardation that occurs, but it is difficult to quantify given the complexity and uncertainty of the system.

e. *Identification of impacted or potentially impacted sensitive receptors*: The following sensitive receptors have been identified:

i. Impacted or potentially impacted drinking water wells within CAA I and CAA II as identified in Appendix B. At this time, approximately 335 drinking water wells have PFOA concentrations at or above 20 ppt.

ii. Water supply source protection areas. Based on the investigation to date, the water sources for the two major water supplies

(Town of Bennington and North Bennington Water District) have non-detect (less than 2 ng/l (ppt)) levels for the five targeted PFAS. There are currently four public transient non-community water systems that have the targeted five PFAS with concentrations at or above 20 ppt.

iii. Aquatic features (surface waters, sediment, and wetlands): Surface water, sediment, and fish sampling results were not at levels considered by the State of Vermont to be a potential concern to human health. Further, results were not at a level that ANR considered requiring remediation for recreational use of these waters and the most sensitive aquatic species.

iv. Human direct contact with soil: All soil samples outside the former Chemfab facility on Water Street were below the Vermont soil screening level (300 ppb for PFOA) for direct contact. Therefore, there is not human direct contact concern with area-wide soils

v. Agricultural farms and gardens: The Vermont Agency of Agriculture, Food, and Markets indicated that they do not expect to find detectable amounts of PFOA in home or commercially grown produce, with the caveat that water with PFOA below 20 ppt should be used to irrigate crops.

f. *Conceptual Site Model*: Barr created a CSM based on existing data and available information and then tested their CSM by performing site investigation activities described in the document referenced in Paragraph 1(d).

The CSM used several numerical environmental models to evaluate where air emissions from the two Chemfab facilities are a potential source of the PFAS found, primarily in groundwater within the North Bennington and Bennington areas. The modeling with the CSM focused primarily on PFOA since this compound was the most prominent compound found in soil and groundwater. The evaluation to simulate the complete PFOA transport pathway from source to sensitive receptors included the following models to evaluate fate and transport through the air, unsaturated zone, and groundwater:

i. AERMOD: Air dispersion and deposition from the two former Chemfab facilities was estimated using this model. This model provided an estimate of the aerial extent and mass of PFOA emissions that deposited around the facility and within the model domain.

ii. Soil-Water Balance Water (SWB): This model was used to estimate infiltration rates of PFOA into the ground.

iii. MODFLOW-NWT and MT3D-USGS: These models were used to simulate the leaching and retention of PFOA through the unsaturated zone and PFOA movement in groundwater. This model incorporates the infiltration rates from the SWB Model and mass deposition rates estimated from the AERMOD.

14. Assumptions and limitations of the CSM:

a. Uncertainty in all parameter values and the lack of complete site-wide data given the scale of the aerial extent of the contamination and nonuniformity of the site-wide physical setting,

b. Uncertainty in assumptions used in the numerical models to simulate transport from source to receptor.

15. Findings of the CSM in which ANR concurs:

a. No municipally-operated public water supply wells have tested at or above 20 ppt or above detection limits for the five targeted PFAS.

b. The CSM states that airborne emissions of PFAS from the former Chemfab facilities may have contributed to the PFOA and other PFAS detected in water supply wells within CAA I. ANR has determined from independent air modelling that airborne emissions of PFAS from the former Chemfab facilities contributed to the PFOA and other PFAS detected in CAA I and CAA II.

c. Transport through the soil column likely produced a lag between the time PFOA was deposited on the ground surface and the time PFOA reached groundwater.

16. ANR does not concur with a major finding of the CSM, which was that the modeling indicates that concentrations of PFOA detected in private water supply wells outside of CAA I are likely not attributable to air emissions from the facilities.

17. On the behalf of ANR, Amec Foster Wheeler Infrastructure and Environment, Inc. prepared an independent CSM (Draft Conceptual Site Model for PFOA Contamination: Bennington VT June 2018), which concluded that air emissions from Saint-Gobain/Chemfab facilities resulted in PFOA in groundwater

at or above the VGES throughout CAA II. Support for their conclusion includes, but not limited to, the following:

a. The amount of PFOA (and other PFAS) used at the facilities is greater than estimated by Saint-Gobain based on a review of Chemfab's records;

b. Their independent air model indicates that the two former Saint-Gobain/Chemfab facilities released PFOA over a greater area and at a greater concentration than estimated by Barr's model;

c. The two former Saint-Gobain facilities are also major sources of multiple PFAS identified throughout CAA I and CAA II based on a review of Chemfab records, the presence of multiple PFAS used at the Water Street facility, the presence of multiple PFAS in soils located around the Water Street facility, the presence of multiple PFAS in monitoring wells at the Water Street facility, and the presence of multiple PFAS in stack residue and emissions testing data from Saint-Gobain's Merrimack New Hampshire Plant.

18. Based on the information above, the ANR has concluded that for the purposes of determining the appropriate corrective action remedies for CAA II, the Settling Defendant has met the Site Investigation requirements of the IROCPR, subject to addressing data gaps and further comments and concerns identified in the CSM.

V. BASIS FOR CONDITIONAL CONCURRENCE OF EVALUATION OF CORRECTIVE ACTION ALTERNATIVES FOR CAA II

19. This Section describes the process that ANR used to determine that the Evaluation of Corrective Action Alternatives (ECAA): Corrective Action Area II prepared by Barr Engineering on behalf of Settling Defendants dated March 2019 meets the requirements for an ECAA as provided in the IROCPR.

20. The IROCPR specifies that the following technical elements must be addressed in an ECAA:

a. Identification of the objectives and goals of the corrective action;

b. Evaluation of the technical, regulatory (legal), cultural and economic feasibility of remedial alternatives capable of achieving the corrective action objectives, with a detailed evaluation of one or more remedial options, including a conceptual design of chosen remediation method;

c. Discussion of waste stream treatment and/or disposal requirements (where applicable);

d. Identification of need for institutional controls, such as deed restrictions, groundwater reclassification, municipal ordinance, etc.; and

e. Environmental Impact of Proposed Remediation.

21. Evaluation of Corrective Action Alternative and Selection of Remedy. The recommended corrective action in the ECAA prepared by Barr Engineering is monitored natural attenuation for a groundwater remedy and a combination of the

following corrective actions to ensure a potable drinking water supply for residences and businesses:

a. Operation of POET systems for water supplies at or above the VGES for the five targeted PFAS in areas where municipal waterlines either are not implementable or are significantly more expensive than continued O&M of POET systems.

b. Installation of municipal waterlines in areas where waterlines may be more easily implemented or cost less than long-term O&M of existing POET systems, due to the proximity to existing waterlines, the number and density of wells with POET systems, and/or elevated concentrations of PFAS that may result in a POET system operating for a longer period than in other areas.

c. Replacement of selected wells at locations where shallow wells with concentrations of PFAS above the performance standard are located within a larger area of wells with PFAS concentrations below the performance standard. Barr proposes that natural attenuation will be assessed by long-term monitoring of wells with concentrations of PFAS below the performance standard and long-term monitoring of groundwater at selected drinking water wells and monitoring wells.

22. Active remediation options that remediate soil and groundwater, such as physical barriers, cut-off walls, reactive barrier walls, *in situ* treatment, low-permeability capping, pump and treat, and oil excavation, were not considered in detail in this ECAA. Barr Engineering previously evaluated active remediation

options as part of the comparative analysis of corrective actions for CAA I and determined that active remediation was not technically feasible, cost effective, nor would it increase the protectiveness of human health and the environment (Comparative Analysis of Corrective Action Options for CAA 1 prepared by Barr Engineering 2017).

23. Evaluation of corrective action options followed the criteria in §35-503 of the IROCPR:

a. Compliance with Legal Requirements

b. Overall Protection of Human Health and the Environment

c. Long-Term Effectiveness and Permanence

d. Reducing Toxicity, Mobility, and Volume

e. Short-Term Effectiveness

f. Implementability

g. Cost

h. Environmental Impact and Sustainability

i. Community acceptance.

24. Although ANR does not concur with every part of the ECAA, ANR concurs that the alternative analysis in Barr Engineering's ECAA adequately addresses the elements for an evaluation of corrective action alternatives as described in the ICROPR.

25. ANR concurs that POETs (provided that they are properly maintained), well replacement, and Expansion of Municipal Water Lines are

options that are potentially viable to provide potable water to residents/businesses and concurs with monitoring natural attenuation for the groundwater remedy.

26. ANR considers municipal connection as the preferred option for all areas unless connection for a given area is not technically feasible (such as unacceptable disinfectant by-products or insufficient chlorine residual); costs for connection are significantly greater than the cost to operate a POET system long-term, or individuals located at the end of a water line do not want municipal water. ANR's next preferred option, where technically appropriate, is the installation of a replacement well where POET operation and maintenance continue until the ANR has sufficient data to determine that PFAS levels are at or below the performance standard, in accordance with the protocol set forth in the Consent Order.

27. Barr's recommendations were similar but emphasized cost as a primary criterion in selecting POETs instead of waterlines. In addition, ANR does not concur with the assumption used in Table 1 (Summary of Estimated Costs for Corrective Action): Barr Engineering assumed that POETS would only need to operate for 20 years. Based on the uncertainty of the assumptions and parameters in Barr's CSM dated June 2017, the ANR believes that many POET systems, particularly closer to and in the dominant down-wind direction of the plant, will be impacted for longer than 20-30 years. Therefore, lifetime POETs O&M costs will likely be higher than those listed in Table 1.

28. ANR also does not concur with the following scoring summarized in Table 2 (Corrective Action Criteria Scoring Summary):

a. Community Acceptance POET systems. Barr Engineering scored community acceptance as High for the installation and operation of POET Systems. Based on community feedback from the survey performed by the public water systems, public meetings, and personal communication, a majority of the community does not believe that POETs are a desirable long-term option. Given the above, ANR believes that community acceptance for POETs as a long-term remedy is Low.

b. Overall Protectiveness of Human Health and the Environment for well replacement. Barr Engineering scores as Medium, the ANR considers the score as Medium-High because the replacement well will keep its POET system in operation until it can be shown to be in accordance with the protocol set forth in the Consent Order that the targeted five PFAS are at or below the VGES.

c. Well Replacement – Implementability. Barr Engineering scored as medium. ANR believes that the score is High, provided that the proper characterization is done prior to well placement and the well is properly constructed and given the success of replacement wells, so far, in CAA I.

29. ANR reserves the right to require active remediation / corrective action in localized areas, such as the two facilities' operational units and to require, as part of the five-year review identified in the Consent Order, to re-

evaluate the viability and feasibility of the ongoing corrective actions measures; and to assess other potential corrective action remedies for both the area-wide drinking water and groundwater remedies.