Conceptual Drinking Water Supply Plan

Long-term options for the East Metropolitan Area

MINNESOTA

c-pfc1-23

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Contents

Glossary

3M Grant for Water Quality and Sustainability Fund (Grant) – Under terms of the Settlement, an $850 million Grant was provided by 3M to the State to be used to enhance the quality, quantity, and sustainability of the drinking water in the East Metropolitan Area; to restore and enhance natural resources and outdoor recreational opportunities; and to reimburse the State for certain other expenses.

2007 Consent Order – An agreement between 3M and the MPCA requiring 3M to investigate and take remedial actions to address releases and threatened releases of PFAS from the 3M Cottage Grove Site, the 3M Oakdale Disposal Site, and the 3M Woodbury Disposal Site; and to reimburse the Minnesota Pollution Control Agency (MPCA) for its costs to oversee the remediation actions taken under the Consent Order to help provide safe drinking water to affected homes and communities (e.g., installation of temporary or permanent treatment).

2018 Agreement and Order (Settlement) – An agreement to settle the State's Natural Resources Damage lawsuit against 3M for $850 million. Minnesota's Attorney General sued 3M in 2010, alleging that the company's disposal of PFAS had damaged and continues to damage drinking water and natural resources in the East Metropolitan Area. After legal and other expenses were paid, about $720 million is available to finance drinking water and natural resource projects in this region. The MPCA and the Minnesota Department of Natural Resources (DNR) are Co-Trustees of these funds.

Alignment – Location of water lines relative to other infrastructure, typically roadways.

Aquifer – An underground layer of water-bearing permeable rock; rock fractures; or loose, unpacked materials (gravel, sand, or silt). In a water-table (unconfined) aquifer, the water table (upper water surface) rises and falls with the amount of water in the aquifer. In a confined aquifer, layers of impermeable material both above and below cause the water to be under pressure, so that when the aquifer is penetrated by a well, the water will rise above the top of the aquifer (artesian condition).

Aquitard – An underground layer that has low permeability and limits, but does not completely prevent the flow of water to or from an adjacent aquifer.

Booster pump station – A pump station located within the water supply system that is designed to boost the pressure of water within a long pipeline.

Capital costs – One-time costs to build or rebuild infrastructure, including water treatment plants, wells, distribution systems, and other facilities.

Centralized system – A centralized water treatment approach for a given service that treats water at a single treatment facility in a central location and then distributes the water via a dedicated water distribution network across the service area.

Citizen-Business Group – One of three work groups to help the MPCA and the DNR identify and recommend priorities and projects for Settlement funding. This group is composed of the MPCA; the DNR; and about 15 citizen, business, and nongovernmental representatives who live or work in the East Metropolitan Area. One representative from the Government and 3M Working Group serves as a liaison to this group.

Conceptual Drinking Water Supply Plan (Conceptual Plan) – This plan, developed from a strategic planning effort as a step toward addressing the goal of Priority 1 of the Settlement, which is to ensure safe drinking water in sufficient supply to residents and businesses in the East Metropolitan Area to meet current and future needs. The Conceptual Plan presents a recommendation consisting of sets of conceptual projects (called scenarios) that, when combined, address drinking water quality and quantity issues for the 14 communities currently known to be affected by per- and polyfluoroalkyl substances (PFAS) contamination in the East Metropolitan Area. This Conceptual Plan will be used to guide the development and implementation of projects to be funded under the Grant.

Conceptual projects – Project ideas developed by the work groups, members of the public, and the Co-Trustees to address PFAS-related drinking water quality and quantity issues in the East Metropolitan Area. These conceptual projects are consistent with the water supply improvement options, but provide more detail, such as information on project location(s), project component(s), and PFAS treatment technologies.

Conceptual site model (CSM) – A simplified set of assumptions, data, and information that was used to develop a picture of how the groundwater system functions as the basis for developing the more detailed groundwater model.

Co-Trustees – The MPCA and DNR. Under the Minnesota Environmental Response and Liability Act (MERLA), the State on Minnesota (State) is the Trustee for all natural resources in the State, including air, water, and wildlife. The Governor's Executive Order 19-29 (inclusive of 11-09) designated the Commissioners of the MPCA and DNR as Co-Trustees for natural resources under MERLA and other laws.

Decentralized system – A decentralized water treatment approach that may rely on multiple treatment facilities at various locations to serve communities/neighborhoods in a given service area. Typically, these treatment facilities are far enough apart that it mitigates the cost and/or water quality concerns of a centralized treatment facility. On a much smaller scale, a decentralized system may also rely on point-of-entry treatment systems (POETSs) or point-of-use treatments (POUTs) that are installed at individual homes or businesses to achieve potable water.

Distribution line – A smaller diameter line, typically between 6 and 16 inches, that supplies water to consumers.

Distribution system – The portion of a water supply network that conveys potable water from transmission lines to water consumers and provides for residential, commercial, industrial, and fire-fighting water demand requirements. A distribution system can contain distribution lines, booster pump stations, pressure-reducing valves, and storage facilities such as water storage tanks or towers.

Drinking water distribution model – A comprehensive representation of the current and planned drinking water supply infrastructure in the East Metropolitan Area, used to support the evaluation of scenarios in this Conceptual Plan. The model includes information on drinking water supply infrastructure (e.g., connections, demand, water use, available water supply, system pressures, layouts and locations of infrastructure) as well as private and non-community public supply well data.

Drinking Water Supply Technical Subgroup (Subgroup 1) – One of the three work groups; composed of technical experts and formed to analyze options, deliver assessments, and provide advice for long-term options for drinking water supply and treatment to the Government and 3M Working Group, and the Citizen-Business Group.

East Metropolitan Area – Communities to the east of the Minneapolis/St. Paul Metropolitan Area that have been affected by PFAS releases from the 3M Company (3M) source areas. Currently includes the cities of Afton, Cottage Grove, Lake Elmo, Lakeland, Lakeland Shores, Maplewood, Newport, Oakdale, St. Paul Park, and Woodbury; the townships of Denmark, Grey Cloud Island, and West Lakeland; and the Prairie Island Indian Community.

EPA Health Advisory Levels (HALs) – Non-enforceable and non-regulatory technical guidance for state agencies and other public health officials on health effects, analytical methodologies, and treatment technologies associated with drinking water contamination. HALs are based on non-cancer health effects for different lengths of exposure (1 day, 10 days, or a lifetime). In 2016, the U.S. Environmental Protection Agency (EPA) released HALs for perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS).

Government and 3M Working Group – One of three work groups to help the Co-Trustees identify and recommend priorities and projects for Settlement funding. The formation of a working group consisting of representatives from the MPCA, the DNR, Washington County, the East Metropolitan Area communities, and 3M to identify and recommend projects was a requirement of the 2018 Agreement and Order (Settlement). One representative from the Citizen-Business Group serves as a liaison to this group.

Granular activated carbon (GAC) – GAC is made from raw organic materials (such as coconut shells or coal) that are high in carbon. Heat, in the absence of oxygen, is used to increase (activate) the surface area of the carbon, which is why these filters are sometimes referred to as “charcoal” filters. The activated carbon removes certain chemicals that are dissolved in water passing through a filter containing GAC, by trapping (adsorbing) the chemical onto the GAC.

Groundwater Management Area – A designation created by the Minnesota legislature as a tool for the DNR to address difficult groundwater-related resource challenges. Within these areas, the DNR may limit total annual water appropriations and uses to ensure sustainable use of groundwater that protects ecosystems, water quality, and the ability of future generations to meet their own needs. Washington County, along with Ramsey County and portions of Anoka and Hennepin Counties, falls within the North and East Metropolitan Groundwater Management Area.

Groundwater model – A numerical, three-dimensional representation of the groundwater aquifers in the East Metropolitan Area used to support the evaluation of scenarios in this Conceptual Plan. The purpose of the groundwater model is to provide insight into the current groundwater flow system, and predict impacts to flow paths and groundwater resources through the year 2040 from the proposed scenarios. These flow paths and quantity estimates are based on projected groundwater recharge/precipitation rates, surface water elevations, and pumping volumes of the proposed scenarios.

Health advisory – Notice from MDH that a drinking water supply has exceeded health-based guidance values developed by MDH.

Health-based value (HBV) – A health-based water guidance value developed by the Minnesota Department of Health (MDH) using the same scientific methods as health risk limits (HRLs), including peer review. Like an HRL, it is the concentration of a water contaminant, or a mixture of contaminants, that, based on current knowledge, can be consumed with little or no risk to health by the most exposed and sensitive individuals in a population. HBVs are developed to provide water guidance between rule-making cycles for chemicals that may have been recently detected in the water or for which new health information has become available.

Health risk index (HRI; health index, HI) – An indicator of the combined risk of exposure to PFAS compounds that cause the same health effects. It is determined by calculating the concentration of each PFAS compound divided by its HRL or HBV, and adding the resulting ratios. An HI equal to or greater than one indicates possible combined effects. The HRI is referred to interchangeably throughout the document as the health risk index, the health index, the HI, or the HRI. While HRI and HI are terms used for every chemical, the Conceptual Plan always uses them in reference to PFAS contamination. See the definition for PFAS for more information.

Health risk limit (HRL) – A health-based water guidance value developed by MDH that has been promulgated through the Minnesota rule-making process, which includes peer review and public input. It is the concentration of a groundwater contaminant, or a mixture of contaminants, that, based on current knowledge, can be consumed with little or no risk to health by the most exposed and sensitive individuals in a population.

High-service pumps – Pumps located at the water treatment facility that deliver large volumes of treated, potable water to the water supply system.

Horizontal directional drilling – A minimal impact trenchless method of installing underground utilities such as pipe, conduit, or cables in a relatively shallow arc or radius along a prescribed underground path using a surface-launched drilling rig.

Ion exchange (IX) – IX processes are reversible chemical reactions for removing dissolved ions from a solution and replacing them with other similarly charged ions. In water treatment, it is primarily used for softening, where calcium and magnesium ions are removed from water; however, it is being used more frequently for the removal of other dissolved ionic species.

Jack and bore – A method of horizontal boring construction for installing casing or steel pipes under roads or railways. Construction crews drill a hole underground horizontally between two points (the sending and receiving pits) without disturbing the surface in between. This is accomplished by using an auger boring machine that inserts casing pipe as it moves through the earth while simultaneously removing the soil from within the casing pipe.

Maximum contaminant level (MCL) – The maximum level of a contaminant allowed in water delivered from a public water supply. MCLs are set by EPA through a scientific process that evaluates the health impacts of the contaminant and the technology and cost required for prevention, monitoring, and/or treatment. States are allowed to enforce lower (i.e., stricter) standards than MCLs, but are not allowed to enforce higher (i.e., less strict) standards.

Metropolitan Council – The regional policy-making body, planning agency, and provider of essential services for the Twin Cities metropolitan region, including transportation, wastewater, water supply planning, growth planning, parks and trails, and affordable housing. The Minnesota Legislature established the Metropolitan Council in 1967; it has 17 members who are appointed by the Governor.

Municipal supply well – A drinking water well that serves as a source of water for a municipal water system.

Municipal water system – Refers to an existing municipality's drinking or potable water treatment and distribution system.

Non-community public supply well – A well that provides water to the public in places other than their homes – where people work, gather, and play (e.g., schools, offices, factories, childcare centers, or parks) – and is part of a non-community public water system (see definition below).

Non-community public water system – A drinking water system that supplies water from private water supply well(s) on a year-round basis to:

- A residential development with six or more private residences (e.g., apartment buildings, private subdivisions, condominiums, townhouse complexes, mobile home parks), or
- A mobile home park or campground with six or more sites with a water service hookup.

Non-municipal well – A well that is considered non-municipal in this Conceptual Plan, and includes domestic, irrigation, commercial, and non-community public water supply wells.

Operations and maintenance (O&M) – All work activities necessary to operate and maintain all water treatment and supply facilities from the source of water through the distribution systems.

Per- and polyfluoroalkyl substances (PFAS) – A family of synthetic chemicals, initially developed by 3M, used to make products that resist heat, oil, stains, grease, and water. They are extremely resistant to breakdown in the environment, accumulate in humans and animals, and are "emerging contaminants" that are the focus of active research and study. Specific chemicals within the PFAS family include perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS), perfluorohexane sulfonate (PFHxS), perfluorobutane sulfonate (PFBS), and perfluorobutanoic acid (PFBA).

Point-of-entry treatment system (POETS) – Water treatment system installed on the water line as it enters an individual home, business, school, or other building. These systems treat all the water entering the building.

Point-of-use treatment (POUT) – Water treatment system installed on the water line at the point of use, such as a faucet.

Pressure-reducing stations – Locations within the water supply system where a pressure-reducing valve has been installed.

Pressure-reducing valves – A valve fitted in a pipe system, which, in spite of varying pressures on the inlet side (inlet pressure), ensures that a certain pressure on the outlet side (outlet pressure) is not exceeded, thus protecting the components and equipment on the outlet side.

Priority 1 – The first priority of the Grant is to enhance the quality, quantity, and sustainability of drinking water in the East Metropolitan Area. The goal of this highest-priority work is to ensure safe drinking water in sufficient supply to residents and businesses in the East Metropolitan Area to meet their current and future water needs. Examples of projects in this first priority may include, but are not limited to, the development of alternative drinking water sources for municipalities and individual households (including, but not limited to, creation or relocation of municipal wells), the treatment of existing water supplies, water conservation and efficiency, open-space acquisition, and groundwater recharge (including projects that encourage, enhance, and assist groundwater recharge). For individual households, projects may include, but are not limited to, connecting those residences to municipal water supplies, providing individual treatment systems, or constructing new wells.

Priority 2 – The second priority of the Settlement is to restore and enhance aquatic resources, wildlife, habitat, fishing, resource improvement, and outdoor recreational opportunities in the East Metropolitan Area and in downstream areas of the Mississippi and St. Croix Rivers. The Co-Trustees have immediate access to $20 million in Settlement funds for projects in this priority category. After the safe drinking water goals of the first priority have been reasonably achieved, all remaining Settlement funds will then be available for natural resource restoration and enhancement projects.

Priority 3 – If funds remain after the first two priority goals have been met, the Grant can be used for statewide environmental improvement projects. Only projects in categories such as statewide water resources, habitat restoration, open space preservation, recreation improvements, or other sustainability projects would be eligible.

Private well – A domestic drinking water well that is not part of a public water system. The quality and safety of water from private wells are not regulated by the federal Safe Drinking Water Act, nor in most cases by state laws.

Public supply well – A drinking water well that serves as a source of water for a public water system.

Public water system – A regulatory term under the federal Safe Drinking Water Act for a drinking water supply system that serves at least 15 homes or 25 people for at least 60 days a year.

Recharge – Water added to the aquifer from the surface through the unsaturated (dry or vadose) zone in the uppermost soils through processes called infiltration and percolation following any precipitation (rain or snow) event.

Regional water supply system – A water system that supplies potable water to more than one community or water system.

Scenarios – Sets of conceptual projects that consider water supply, distribution, and demand, and are evaluated in this Conceptual Plan using drinking water distribution and groundwater models.

Small community water system – A private and voluntary water system that serves neighborhood-sized clusters of residences.

Special Well Boring and Construction Area (SWBCA) – A mechanism that provides for controls on the drilling or alteration of wells in an area where groundwater contamination has resulted or may result in risks to public health. The purposes of an SWBCA are to inform the public of potential health risks in areas of groundwater contamination, provide for the construction of safe water supplies, and prevent the spread of contamination due to the improper drilling of wells or borings.

Sustainability – Responsible interaction with the environment to provide, improve, and protect the drinking water for future generations by lessening environmental impacts, thoughtfully managing demands, and empowering conservation through education and targeted projects. Minnesota Statute § 103G.287, subd. 5, describes groundwater sustainability as the development and use of groundwater resources to meet current and future beneficial uses without causing unacceptable environmental or socioeconomic consequences.

Transmission line – A large-diameter pipeline designed to convey large volumes of water at higher pressures from a source (typically a water treatment facility) to a distribution system for use. Water transmission lines are typically larger in diameter (greater than 16 inches), and consumers are not typically placed on transmission lines because of their high velocities and pressures.

Watershed districts – Special government entities that monitor and regulate the use of water within certain watersheds in Minnesota, rather than within political boundaries, which were first authorized by the legislature in 1955.

Water storage tank – A water storage facility consisting of a cylindrical tank that has a base elevation at the existing ground surface. Storage facilities provide sufficient water volume to meet peak hour water demands.

Water storage tower – An elevated water storage facility (also referred to as a water tower) that supports a water storage tank with a base elevation above the existing ground surface to provide sufficient pressure to the water distribution system, and to provide emergency storage for fire protection.

Water supply improvement options – A reasonable range of options that could improve drinking water quality and quantity, including both centralized and decentralized systems, which are evaluated against a set of screening criteria in this Conceptual Plan to determine their relevance to the individual communities in the East Metropolitan Area.

Water supply system – A system for the treatment, transmission, storage, and distribution of water from source to consumers (e.g., homes, commercial establishments, industry, irrigation facilities, and public agencies for water).

Work groups – Three groups formed by the Co-Trustees to help identify and recommend priorities and projects for Settlement funding: the Government and 3M Working Group, the Citizen-Business Group, and the Drinking Water Supply Technical Subgroup.

Acronyms and abbreviations

AACE	Association for the Advancement of Cost Engineering
Abt	Abt Associates
ADD	average daily demand
CAD	computer-aided design
Conceptual Plan	Conceptual Drinking Water Supply Plan
CSM	conceptual site model
DNR	Minnesota Department of Natural Resources
EPA	United States Environmental Protection Agency
GAC	granular activated carbon
GIS	geographic information system
Grant	3M Grant for Water Quality and Sustainability Fund
GWTP	groundwater treatment plant
HAL	EPA Health Advisory Level
HBV	health-based value
HI	health index (used interchangeably with HRI)
HRI	health risk index (used interchangeably with HI)
HRL	health risk limit
IX	ion exchange
MCES	Metropolitan Council Environmental Services
MCL	maximum contaminant level
MDH	Minnesota Department of Health
MERLA	Minnesota Environmental Response and Liability Act
mgd	million gallons per day
MGS	Minnesota Geological Survey
MPCA	Minnesota Pollution Control Agency
N/A	not applicable
NPS	National Park Service
O&M	operations and maintenance
PFAS	per- and polyfluoroalkyl substances
PFBA	perfluorobutanoic acid
PFBS	perfluorobutane sulfonate
PFHxS	perfluorohexane sulfonate
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
POETS	point-of-entry treatment system
POUT	point-of-use treatment
QA/QC	quality assurance/quality control
Settlement	2018 Agreement and Order
SPRWS	St. Paul Regional Water Services
State	State of Minnesota
Subgroup 1	Drinking Water Supply Technical Subgroup
SWBCA	Special Well Boring and Construction Area

SWTP	surface water treatment plant
3M	3M Company
2007 Consent Order	2007 Settlement Agreement and Consent Order
TCE	trichloroethylene
VOC	volatile organic compound
Wood	Wood Environment & Infrastructure Solutions, Inc.

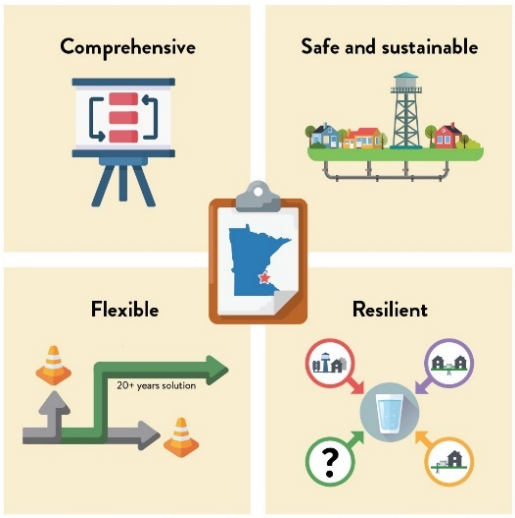
Executive summary

Introduction

This document presents a Conceptual Drinking Water Supply Plan for providing safe, sustainable drinking water to the 14 communities in the East Metropolitan Area of the Twin Cities that are currently known to be affected by groundwater contaminated with per- and polyfluoroalkyl substances, commonly known as PFAS. In February 2018, the State of Minnesota and the 3M Company (3M) announced an agreement to settle the State's Natural Resources Damage lawsuit for PFAS contamination in the East Metropolitan Area. The Settlement agreement's first and highest priority is to enhance the quality, quantity, and sustainability of drinking water in the East Metropolitan Area, with the goal of ensuring safe drinking water in sufficient supply to residents and businesses in the East Metropolitan Area to meet their current and future drinking water needs. The Settlement established a grant from 3M to the State, which provides about $700 million to address drinking water needs. The Minnesota Pollution Control Agency and Department of Natural Resources serve as Co-Trustees for implementation of the Settlement. This Conceptual Plan documents a three-year process to address the Settlement's highest priority, and describes the Final Plan for providing safe and sustainable drinking water to the affected communities.

Summary of the Final Plan

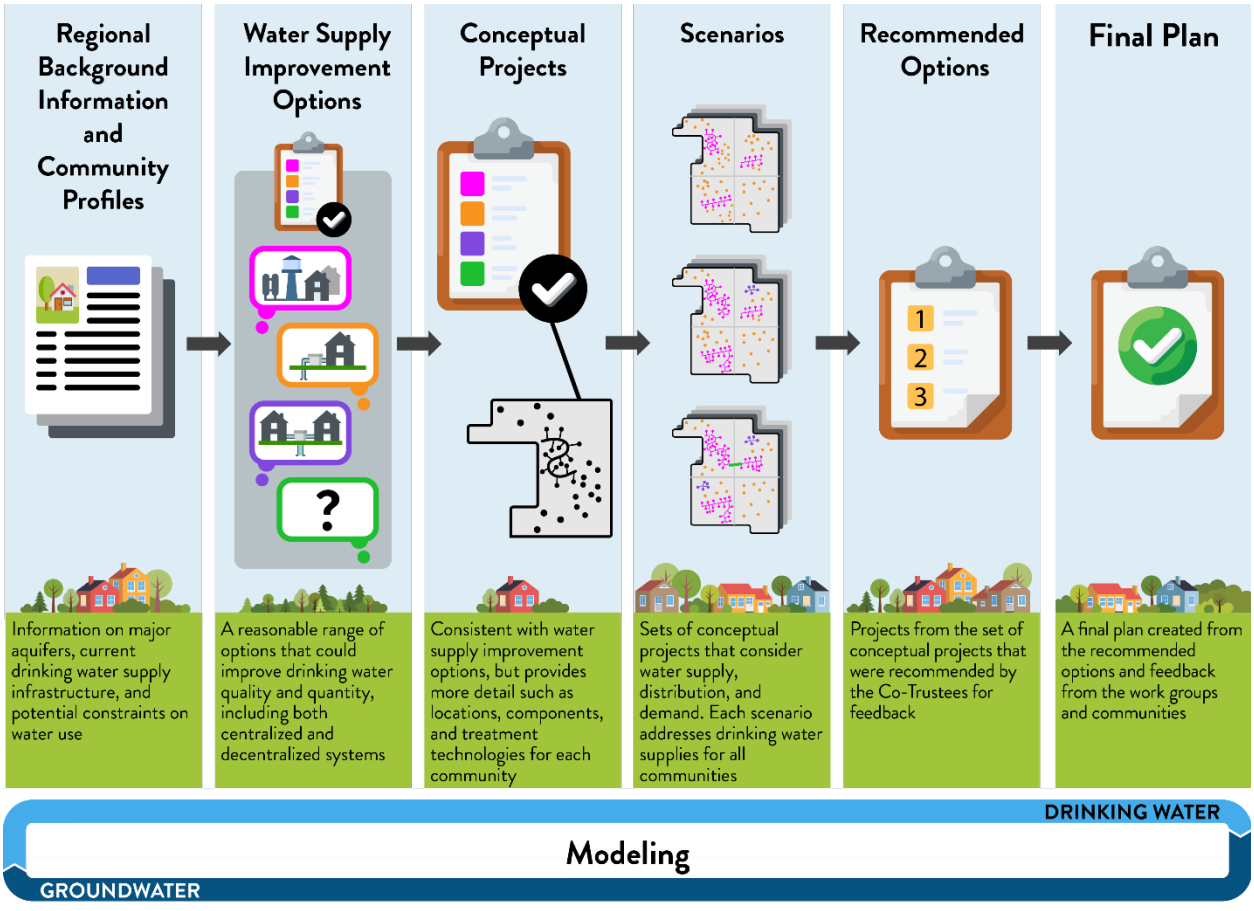
The Final Plan, described in detail in Chapter 8, identifies drinking water projects for all 14 communities affected by PFAS contamination. The projects are largely based on recommendations by the communities and use groundwater as the drinking water source to the extent possible. Projects include municipal and private well treatment, and pipes and other water distribution infrastructure. The Final Plan includes treatment for wells that meet or exceed a health index value of at least 0.5 using current drinking water guidance values and methods. This treatment threshold is lower than the value that triggers a health advisory for a well, providing resilience against future changes in contamination or changes in health guidance values for PFAS. The use of the health index is explained in detail in Chapter 8.



The Final Plan allocates the majority of the $700 million in available funding to three main priorities: 45% for capital infrastructure, 16% for operation and maintenance, and 10% for drinking water protection. About 26% of funding is set aside to provide flexibility to respond to potential future changes in contamination or other uncertainties.

Approach to developing the Conceptual Plan

The Conceptual Plan was developed in a sequential process (see figure below), supported by drinking water and groundwater modeling to refine a suite of reasonable alternatives to reach a Final Plan.



Three work groups were established to engage communities, stakeholders, and technical experts during this process. These work groups involved over 90 representatives of the 14 affected communities. Each met more than 20 times from 2018 to 2021. The work groups and the Co-Trustees developed a set of long-term goals (see below) and evaluation criteria (see Chapter 6) to help guide the process.

Long-term goals for Priority 1 of the Settlement Agreement

- Provide clean drinking water to residents and businesses to meet current and future needs under changing conditions, population, and health-based values (HBVs), health risk limits (HRLs), and health indices (HIs)
- Protect and improve groundwater quality
- Protect and maintain groundwater quantity
- Minimize long-term cost burdens for communities

In September 2020, the Co-Trustees developed and released for public comment a draft Conceptual Plan that included three draft recommended options (see Chapter 7), and asked the public and government units for feedback and comments on the three recommended options. Based on feedback, the Co-Trustees made decisions on the projects and funding allocations to create the Final Plan, which will provide safe and sustainable drinking water to the 14 affected communities (see Chapters 8 and 9).

1. Introduction

In February 2018, the State of Minnesota and the 3M Company (3M) announced an agreement to settle the State's Natural Resources Damage lawsuit for per- and polyfluoroalkyl substances (PFAS) contamination in the East Metropolitan Area of the Twin Cities. As a result, the State of Minnesota and 3M entered into a 2018 Agreement and Order (Settlement) that established the 3M Grant for Water Quality and Sustainability Fund (Grant). Under the first and highest priority (Priority 1) of this Settlement, the Minnesota Pollution Control Agency (MPCA) and the Minnesota Department of Natural Resources (DNR) will use the Settlement funding for long-term projects to enhance the quality, quantity, and sustainability of drinking water for residents and businesses affected by PFAS in the East Metropolitan Area. As a step toward addressing Priority 1, the Co-Trustees (MPCA and DNR) have developed this Conceptual Drinking Water Supply Plan (Conceptual Plan) to evaluate and recommend a set of projects that provide safe, sustainable drinking water to the 14 communities currently known to be affected by PFAS contamination in the East Metropolitan Area, now and into the future. The Conceptual Plan provides clarity and alignment in direction and decision-making, using best available information and projections, to help the Co-Trustees make fair decisions about project funding using finite available Settlement funds that are consistent with the intent of the Settlement. The options presented here are based on the totality of evaluating all appropriate and feasible alternatives, and incorporate feedback from the work groups and public outreach. Any of the recommended options would be reasonable and necessary in response to PFAS releases in the East Metropolitan Area, and not inconsistent with provisions found in Minn. Stat. 115B, the Minnesota Environmental Response and Liability Act (MERLA).

This chapter provides background information on the Settlement, the overall goals of the planning and implementation effort, an overview of the Conceptual Plan, and information on communication and public involvement.

1.1 Overview of the 2018 Settlement

1.1.1 Background

PFAS are a family of synthetic chemicals initially developed by 3M that have been used since the late 1940s to make products that resist heat, oil, stains, grease, and water. Types of PFAS chemicals include perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), and perfluorobutanoic acid (PFBA), among others. 3M has phased out the manufacture of some PFAS. There are currently other manufacturers of PFAS worldwide.

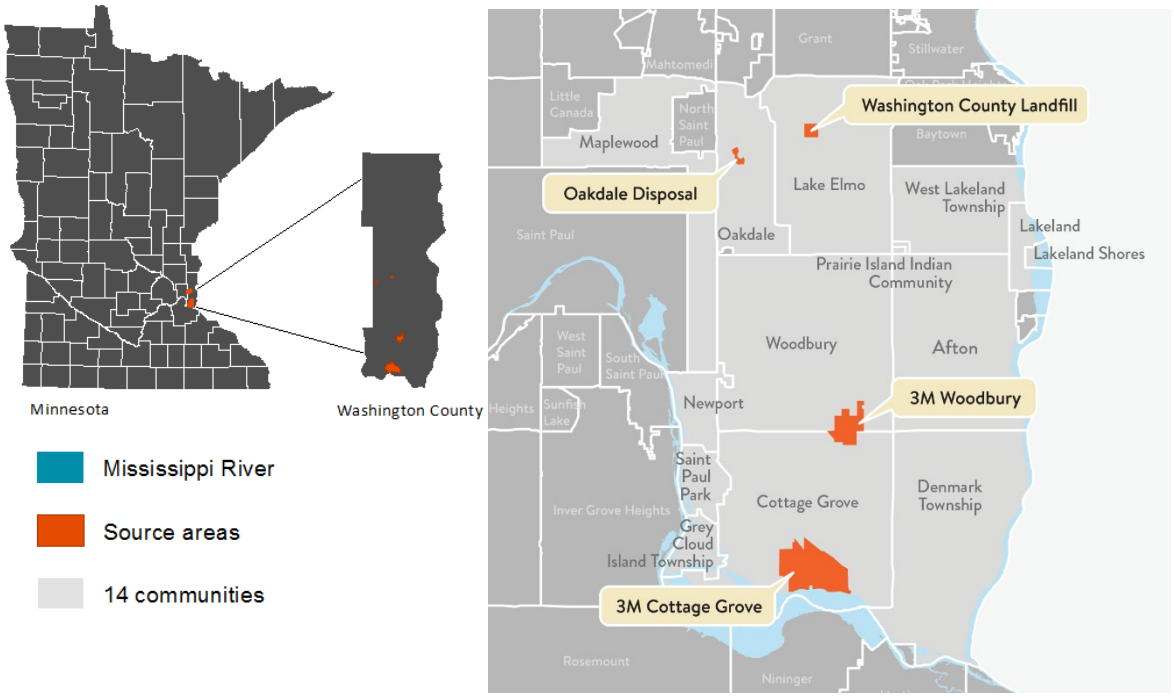
The chemical structures of PFOS and PFOA are quite stable and can persist in the environment for long periods of time, since they do not easily degrade under environmental conditions. Therefore, PFAS, including PFOS and PFOA, can bioaccumulate in humans and animals. The PFAS compounds are "emerging contaminants" that are the focus of active research and study. The Minnesota Department of Health (MDH) is monitoring the growing science about PFAS, and issues health-based guidance accordingly.

PFAS contamination of drinking water wells was first identified in 2004, when concentrations were detected in drinking water supplies in parts of the East Metropolitan Area. The contamination was traced to the disposal of PFAS by 3M at three dump site locations and one landfill in the East

Metropolitan Area. From the 1950s through the early 1970s, 3M disposed of wastes from PFAS manufacturing processes in disposal sites in Oakdale and Woodbury, at the 3M manufacturing facility in Cottage Grove, and at the Washington County landfill (Figure 1.1).

Following the first detections of PFAS in production wells at the 3M Cottage Grove facility, the MPCA requested that 3M conduct additional PFAS sampling of monitoring wells at the three 3M disposal sites (3M Cottage Grove, Woodbury, and Oakdale). The MPCA also conducted sampling of monitoring wells at the Washington County Landfill, which is managed by MPCA's Closed Landfill Program. The MPCA, in coordination with MDH, also began sampling nearby private and public supply wells in Washington County to identify drinking water supplies with PFAS impacts. Sampling soon expanded to a wider part of the East Metropolitan Area. In 2007, 3M entered into a Settlement Agreement and Consent Order (2007 Consent Order) with the MPCA, requiring 3M to investigate and take remedial actions to address releases of PFAS from the three 3M disposal sites. In 2010, Minnesota filed a lawsuit against 3M for damages to natural resources as a result of releases of PFAS chemicals in the East Metropolitan Area.

Figure 1.1. 3M disposal sites in the East Metropolitan Area.



1.1.2 Settlement

On February 20, 2018, the State of Minnesota (State) settled its Natural Resources Damage lawsuit against 3M in return for $850 million. These funds were provided to the State as a Grant described above. After legal and other expenses were paid, about $720 million remains available to fund drinking water and natural resource projects in the East Metropolitan Area. The Co-Trustees are responsible for ensuring that funds from the Settlement are used for projects to enhance the quality, quantity, and sustainability of drinking water in the East Metropolitan Area; and for natural resource restoration and enhancement (see Section 1.1.3 for more-detailed information on the priorities of the Settlement).

In addition to the 2018 Settlement, the 2007 Consent Order between the MPCA and 3M remains in place, requiring 3M to continue to perform remediation related to releases at and from the 3M Cottage

Grove Site, the 3M Oakdale Disposal Site, and the 3M Woodbury Disposal Site and to reimburse the MPCA for its costs to oversee the remediation.

In addition, for the first five years after the 2018 Settlement, 3M is required to pay up to $40 million for short-term drinking water needs under the terms of the 2007 Consent Order. This includes, for example, expenses for:

- Providing bottled water and installing temporary in-home water filtering systems to residents with PFAS-contaminated wells that have been issued health advisories from MDH.
- The operations and maintenance (O&M) of temporary drinking water treatment systems for municipalities that have received health advisories from MDH and are not meeting the required community demand (i.e., existing groundwater wells being taken offline due to health advisories). Temporary drinking water treatment systems were installed to treat wells in Cottage Grove in late 2017 and again in spring/summer of 2020, as well as being installed in St. Paul Park and Woodbury during the spring/summer of 2020.

These dollars, which are in addition to Settlement funding, are intended to be used as a bridge to the long-term projects funded under Priority 1.

After five years or when the $40 million has been spent, any remaining short-term drinking water expenses will be covered by Settlement funds if they remain available. After Settlement funds are depleted, 3M, under the 2007 Consent Order, will continue to be required to pay for the cost of providing alternative sources of drinking water when concentrations of PFAS exceed MDH drinking water values, as provided in the 2007 Consent Order.

1.1.3 Priorities

The first and highest priority for Settlement funding is to enhance the quality, quantity, and sustainability of drinking water in the East Metropolitan Area. This area includes, but is not limited to, the cities of Afton, Cottage Grove, Lake Elmo, Lakeland, Lakeland Shores, Maplewood, Newport, Oakdale, St. Paul Park, and Woodbury; the townships of Denmark, Grey Cloud Island, and West Lakeland; and the Prairie Island Indian Community. The goal of Priority 1 is to ensure safe drinking water in sufficient supply to residents and businesses in the East Metropolitan Area to meet their current and future drinking water needs.

Funded projects will address restoration of the provision of clean drinking water in a variety of ways, thereby helping provide the region's residents and businesses with safe drinking water. Such efforts could include, for example, drilling new wells, finding alternative sources of drinking water for communities or private well owners, treating existing drinking water supplies, connecting residences with private wells to public water systems, interconnecting public water systems, and centralizing municipal supply wells to make treatment more feasible. Settlement funds could also support groundwater sustainability with projects such as promoting water conservation or preserving open spaces to help recharge drinking water sources and enhance water quality.

Priority 2 – Enhance natural resources

The second priority for Settlement funding is to restore and enhance aquatic resources, wildlife, habitat, fishing, resource improvement, and outdoor recreational opportunities in the East Metropolitan Area and in downstream areas of the Mississippi and St. Croix Rivers. Projects might include aquatic habitat and water resource protection and restoration; terrestrial and aquatic outdoor recreation facilities; restoration of wildlife habitat; and implementation of other terrestrial conservation and recreational improvements.

The Co-Trustees have immediate access to $20 million in Settlement funds for projects relating to Priority 2. After the safe drinking water goals of Priority 1 are reasonably achieved, all remaining Settlement funds are then available for natural resource restoration and enhancement projects under Priority 2.

Priority 3 – Remaining Settlement funds

If funds remain after the first two priority goals have been met, the Grant can be used for statewide environmental improvement projects. Only projects in categories such as statewide water resources, habitat restoration, open space preservation, outdoor recreation improvements, or other sustainability projects would be eligible.

1.1.4 Roles and responsibilities

Agencies and work groups

The Co-Trustees are responsible for implementing the Settlement. The terms of the Settlement require the Co-Trustees to establish a working group to identify and recommend projects. The Co-Trustees have ultimate responsibility, in their discretion, to determine what projects and other activities will be funded under the Grant.

The Co-Trustees decided to create three work groups – the Government and 3M Working Group, the Citizen-Business Group, and the Drinking Water Supply Technical Subgroup (Subgroup 1) – to engage communities, stakeholders, and technical experts to help identify and recommend priorities and projects for funding under the Grant. Subgroup 1 is composed of technical experts to analyze options, deliver assessments, and provide advice for long-term options for drinking water supply and treatment. The structures of the work groups are described below. See the Minnesota 3M PFC Settlement website (https://3msettlement.state.mn.us/) for additional information on the work groups.

Government and 3M Working Group structure

The Government and 3M Working Group is composed of one representative each from the MPCA, the DNR, 3M, and Washington County; and one representative from each of the following affected communities: the cities of Afton, Cottage Grove, Lake Elmo, Lakeland, Lakeland Shores, Maplewood, Newport, Oakdale, St. Paul Park, and Woodbury; the townships of Denmark, Grey Cloud Island, and West Lakeland; and the Prairie Island Indian Community. One representative from the Citizen-Business Group also serves as a liaison to the Government and 3M Working Group to promote coordination and communication between the two groups.

Citizen-Business Group structure

The Citizen-Business Group is composed of the MPCA, the DNR, and about 15 citizen, business, and nongovernmental representatives who live or work in the East Metropolitan Area. One representative from the Government and 3M Working Group also serves as a liaison to this group to promote coordination and communication between the two groups. The following criteria were used by the Co-Trustees to select representatives from the affected communities:

- Evaluation of a desire to become a member
- Evidence of East Metropolitan Area involvement either as a resident or working in the area
- Skills and abilities, such as personal and professional background and skills; technical abilities; or experience in public engagement, public involvement, or group participation
- Geographic diversity within the East Metropolitan Area

- Ethnic and age diversity
- Representation of individuals and businesses who are on private wells and public water systems
- Diversity of knowledge, skills, backgrounds, and experiences.

Drinking Water Supply Technical Subgroup (Subgroup 1) structure

Subgroup 1 is composed of technical experts from the MPCA, the DNR, MDH, 3M, Washington County, and the Metropolitan Council; and one representative from each of the following affected communities: the cities of Afton, Cottage Grove, Lake Elmo, Lakeland, Lakeland Shores, Maplewood, Newport, Oakdale, St. Paul Park, and Woodbury; the townships of Denmark, Grey Cloud Island, and West Lakeland; and the Prairie Island Indian Community. Also represented in this subgroup are the Minnesota Geological Survey, the Minnesota Rural Water Association, the Minnesota Water Well Association, the Browns Creek Watershed District, the Middle St. Croix Watershed Management Organization, the Ramsey-Washington Metro Watershed District, the South Washington Watershed District, the Valley Branch Watershed District, and the Washington Conservation District. The Co-Trustees co-chair Subgroup 1. Technical experts not affiliated with the subgroup are invited to participate in some meetings on an ad hoc basis to consult on topics within their area of expertise, such as groundwater and sustainability.

Additional support

The Co-Trustees retained Abt Associates (Abt) and Wood Environment & Infrastructure Solutions, Inc. (Wood) to support the development of this Conceptual Plan.

The Co-Trustees selected Abt to coordinate and facilitate implementation activities for the Settlement, including the development of this Conceptual Plan. Abt has expertise with natural resource damage assessment and Settlement implementation. The Co-Trustees selected Wood to provide technical assistance in the development of this Conceptual Plan. Wood has engineering expertise in water system planning, cost estimation, modeling, and treatment, as well as experience in PFAS fate and transport, and treatment strategies.

1.1.5 Communication and public involvement

The Co-Trustees are committed to keeping the public informed about the 3M Settlement implementation process and receiving input from the public. To that end, the Co-Trustees have relied on multiple avenues of information sharing, including the following:

- The Minnesota 3M PFC Settlement website (https://3msettlement.state.mn.us/)
- GovDelivery messages, for which individuals can subscribe to receive updates
- Publicly available reports to the Minnesota Legislature (bi-annual)
- Information in community newsletters, council meetings, and local media
- Work group meetings that are open to the public, and include time for questions and comments from the public
- A series of public meetings specifically about the development of the Conceptual Plan.

1.2 Goals

In collaboration with the work groups, the Co-Trustees developed a set of goals to guide project planning and implementation under the Grant. These goals build upon the priorities in the Settlement and help provide a common understanding of success. The goals include long-term program goals, as well as operational goals that are focused on specific aspects of planning and implementation.

1.2.1 Long-term program goals

The program goals present the long-term vision of success under the Grant. They are aligned with, and organized by, the priorities in the Settlement. At this time, only goals for Priorities 1 and 2 are described. If funding remains after the Co-Trustees have reasonably achieved the goals set forth under Priorities 1 and 2, goals under Priority 3 would be developed.

Priority 1 – Drinking water quality, quantity, and sustainability

- Provide clean drinking water to residents and businesses to meet current and future needs under changing conditions, population, and health-based values (HBVs), health risk limits (HRLs), and health indices (HIs)
- Protect and improve groundwater quality
- Protect and maintain groundwater quantity
- Minimize long-term cost burdens for communities.

Priority 2 – Natural resource restoration, protection, and enhancement

- Restore, protect, and enhance aquatic resources, wildlife, and habitat
- Reduce fish tissue contamination and remove PFAS-based fish consumption advisories
- Improve and enhance outdoor recreational opportunities.

1.2.2 Operational goals

The operational goals are intended to support the efficient and effective achievement of long-term program goals. These operational goals are organized into categories of planning, implementation, governance, public outreach, and monitoring/evaluation/learning.

Planning goals

- Seek a combination of projects that benefit all affected communities.
- Appropriately consider projects that transcend jurisdictional boundaries within the East Metropolitan Area.
- Appropriately consider projects that incorporate the needs of private well owners as well as public or other drinking water systems.
- Rely on science- and evidence-based decision-making and technological advances to achieve priorities and evaluate options.
- Seek cost-effective projects that maximize benefits (such as cost-sharing opportunities, and adding relevant project components to other planned projects).
- Achieve short- and long-term fiscal responsibility (such as employing smart investment strategies, leveraging funds, and allocating funds for future needs).

- Seek to reduce environmental justice health effects, avoid increasing such effects, and enhance access to and use of natural resources for disadvantaged populations.
- Employ procedures that include consideration of stakeholders' input throughout the project selection process.

Implementation goals

- Act with an appropriate sense of urgency, utilizing existing information and analyses to the extent possible.
- Utilize new leading technologies and leverage/incorporate existing infrastructure to the extent feasible.
- Address multiple needs with a combination of strategies and approaches.
- Achieve a process that can serve as a model for other communities facing similar issues.

Governance goals

- Develop a clear planning and decision-making process (such as a process for project evaluation, approval, and funding allocation).
- Respect roles and responsibilities of relevant decision-making authorities.
- Respect and carefully consider recommendations provided by the groups to the Co-Trustees.
- Ensure that expenditure tracking is transparent and meets all state auditing requirements.

Public outreach goals

- Encourage public input and participation in the planning and implementation process.
- Ensure the public is informed of the planning and implementation process and convey information accurately and in a timely manner.
- Ensure public transparency about decision-making.

Monitoring/evaluation/learning goals

- Develop measurable objectives, and evaluate progress against them.
- Employ adaptive management practices of monitoring, assessing progress toward goals, and adjusting processes to achieve goals.
- Provide education to the public about drinking water sources, treatment, and conservation.

1.3 Overview of the Conceptual Plan

The goal of Priority 1 of the Settlement is to ensure safe drinking water in sufficient supply to residents and businesses in the East Metropolitan Area to meet current and future water needs. The Co-Trustees developed this Conceptual Plan as a step toward meeting this goal. The purpose of this Conceptual Plan, and the need for a strategic planning effort and planning process, are discussed below.

1.3.1 Purpose of this Conceptual Plan

The purpose of this document is to present a plan for providing safe, sustainable drinking water to the 14 communities currently known to be affected by PFAS contamination in the East Metropolitan Area, now and into the future. This Conceptual Plan takes into account both public water systems and private wells, considering options within and across communities. To support the evaluation of options, drinking water distribution modeling and groundwater modeling were performed, and included both current conditions as well as projected water demands through 2040. This Conceptual Plan was completed with

input from the Government and 3M Working Group, the Citizen-Business Group, Subgroup 1, and members of the general public.

To the greatest extent possible, development of the Conceptual Plan accounts for other existing and ongoing policy and regulatory processes related to water resources in the East Metropolitan Area. For example, cost estimates for drinking water infrastructure include complying with stormwater management requirements (see chapters 8 and 9). Some relevant policy and regulatory issues were actively evolving during development of the Conceptual Plan, such as litigation related to White Bear Lake water levels. In December 2020, the Minnesota Supreme Court issued a decision related to White Bear Lake, which may affect one or more of the PFAS-affected communities in the East Metro that are the focus of this Conceptual Plan. While the Conceptual Plan is designed to accommodate future decisions, such as White Bear Lake, resolutions to those issues will proceed as independent, yet complimentary, efforts to the implementation of this plan. Descriptions of separate policy and regulatory issues in this Conceptual Plan do not represent official positions or decisions of the State on those issues. Projects implemented under this plan must be in compliance with relevant and appropriate regulatory requirements, where applicable.

1.3.2 Strategic planning effort and planning process

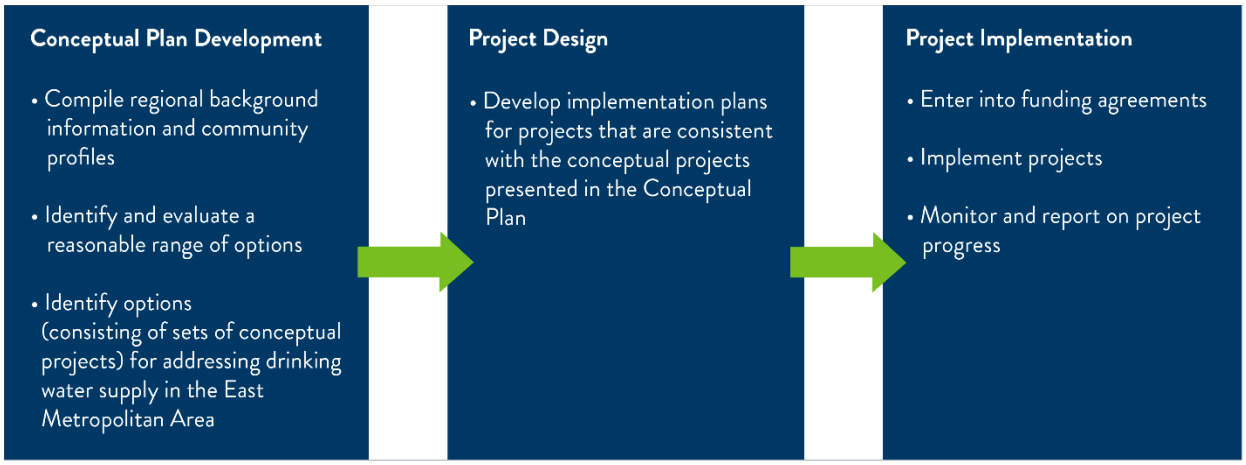
The Co-Trustees determined that a strategic planning effort is required to effectively achieve the goals of Priority 1. This approach allows the affected communities to benefit from shared knowledge, data, and resources; a regional perspective; consistency across the planning effort; and economies of scale. The development of this Conceptual Plan aligns with this strategic planning effort, and considers the region as a whole when addressing drinking water quality, quantity, and sustainability in the East Metropolitan Area.

As described in more detail in Chapter 2, the Conceptual Plan was developed in a sequential process, refining a suite of reasonable alternatives to reach a recommended plan that provides safe, sustainable drinking water to the East Metropolitan Area. The options relate sets of conceptual projects that, when combined, address PFAS-related drinking water quality and quantity issues for the 14 communities currently known to be affected by PFAS contamination. In the development of the options, and ultimately the recommended option, regional groundwater characteristics and community water profiles, including unique community characteristics and growth and development plans, administrative challenges, and water supply constraints, were considered and evaluated throughout the process. Any of the options discussed here would be reasonable and necessary in response to PFAS releases in the East Metropolitan Area, and not inconsistent with provisions found in Minn. Stat. 115B, MERLA.

Following the completion of this Conceptual Plan, the Co-Trustees will request project-specific implementation plans consistent with this Conceptual Plan. Following approval of the selected projects, the Co-Trustees will enter into funding agreements with regional/local/tribal government entities for the implementation of the approved projects (described further below). An overview of the planning and implementation process is shown in Figure 1.2. See Section 1.4 for more information on project selection and implementation.

If a recommended conceptual project is deemed not being feasible upon further consideration, the Co-Trustees will reevaluate the information obtained for this Conceptual Plan to identify an appropriate alternative.

Figure 1.2. Overview of the planning and implementation process.



1.4 Next steps: Project design and implementation

After this Conceptual Plan is developed, the Co-Trustees intend to move forward with funding the implementation of projects to enhance the quality, quantity, and sustainability of drinking water in the East Metropolitan Area. Chapter 10 describes the Co-Trustees' process to implement the projects that are proposed in this Conceptual Plan. Implementation will be driven by the communities through a grant process with the State. The State will review information provided by communities and enter into grant agreements to enable project implementation. Communities will likely have multiple grants over time for different phases of a given project (e.g., planning/design, construction, O&M). Once a grant agreement is in place, each community will follow their own processes for implementation, coordinating with the State as necessary. For private wells, MPCA will continue to manage the installation and maintenance of point-of-entry treatment systems (POETSs) using contractors.

The Co-Trustees have established a strategy for addressing future conditions that are difficult to predict today, such as changes in costs or other project characteristics (e.g., new infrastructure needs that arise during project design) or additional drinking water treatment needs that may arise for various reasons. This is also described in Chapter 10.

1.5 Document contents

This document includes information on the Co-Trustees' plan for enhancing drinking water quality, quantity, and sustainability in the East Metropolitan Area, and is organized as follows:

- Chapter 1 provides an introduction to the document and describes its purpose.
- Chapter 2 presents an overview of the approach used to develop this Conceptual Plan.
- Chapter 3 presents an overview of the region and community profiles.
- Chapter 4 presents water supply improvement options that were identified and evaluated.
- Chapter 5 presents conceptual projects that were identified.
- Chapter 6 presents an overview of the scenarios that were developed and evaluated.
- Chapter 7 provides the Co-Trustees' draft recommended options.
- Chapter 8 provides an overview of the Co-Trustees' final plan.
- Chapter 9 provides additional details about the Co-Trustees' final plan.

- Chapter 10 describes the Co-Trustees' approach to implementation of the final plan.
- Appendix A provides an overview of each of the 14 communities currently known to be affected by PFAS contamination in the East Metropolitan Area
- Appendix B provides an overview of the conceptual site model (CSM) that was developed for the East Metropolitan Area.
- Appendix C provides a summary of the groundwater model setup, calibration, and simulations developed for the East Metropolitan Area.
- Appendix D provides the list of potential conceptual projects identified for each of the 14 communities currently known to be affected by PFAS contamination in the East Metropolitan Area.
- Appendix E presents the detailed modeling and costing results for the three draft recommended options presented in Chapter 7 in support of the final recommendation.
- Appendix F provides supplemental information to Chapter 7, Chapter 8, Chapter 9, and Appendix E, including unit cost estimations, a small community water system analysis, and a treatment technology comparison, as well as background discussions on community treatment plant capacities, calculation of treatment costs including pretreatment, and calculation of treatment media consumptions (treatment O&M).
- Appendix G presents the detailed results of the scenario evaluations for the draft recommended options as they were released in September 2020.
- Appendix H presents the detailed modeling and costing results for the draft recommended options, including the community-specific, regional, treatment, and integrated scenarios, as they were released in the Draft Conceptual Plan in September 2020.

1.6 Preparers

This Conceptual Plan was prepared by the Co-Trustees, with support from Abt and Wood.

2. Approach

This chapter provides a description of the approach used to develop this Conceptual Plan for providing safe, sustainable drinking water to the East Metropolitan Area (Section 2.1). It also provides an overview of the modeling effort used to support the evaluation of drinking water options considered as part of this Conceptual Plan (Section 2.2).

2.1 Description of approach

As described in Chapter 1, the purpose of this document is to present a plan for providing safe, sustainable drinking water to the 14 communities currently known to be affected by PFAS contamination in the East Metropolitan Area, now and into the future. This Conceptual Plan takes into account both public water systems and private wells, considering options within and across communities. To support the evaluation of options, drinking water distribution modeling and groundwater modeling were performed, and include both current conditions and projected water demands through 2040. This year was selected because the comprehensive plans and/or water supply plans for each community, approved by the Metropolitan Council, include population projections to the year 2040.

The Conceptual Plan was developed in a sequential process, refining a suite of reasonable options to reach a plan for providing safe, sustainable drinking water to the East Metropolitan Area. An overview of the step-wise approach is described below.

Step 1: Compile regional background information and community profiles

As a first step, regional background information and community profiles were compiled to identify the characteristics of the East Metropolitan Area, including major aquifers, the current drinking water infrastructure, and potential constraints on water use. This information helped provide bounds on regional models and identify feasible options moving forward. To support this effort, members of Subgroup 1 identified and shared relevant data and information, including current municipal water system infrastructure, location of private wells, and other information. The compilation of regional background information and community profiles are summarized in Chapter 3 of this Conceptual Plan, with more detailed information presented in Appendix A.

Step 2: Identify and evaluate water supply improvement options

As a second step, an initial list of water supply improvement options was identified and evaluated. These options represent general project types that could improve drinking water supply quality and quantity in the East Metropolitan Area, without specifying details such as PFAS treatment technology (if applicable), location, source water, scale, or capacity (incorporated in Step 3 below). These options may include both centralized and decentralized systems. A specific option may be applicable to one or more communities in the East Metropolitan Area. The initial list of water supply improvement options was developed with input from the Government and 3M Working Group, the Citizen-Business Group, and Subgroup 1, as well as through a general public suggestion process. Chapter 4 of this Conceptual Plan presents the list of options identified and evaluated.

Step 3: Identify conceptual projects

As a third step, more specific conceptual projects were identified for each of the affected communities in the East Metropolitan Area. These conceptual projects are consistent with the water supply improvement options from Step 2, but provide more detail, such as information on project location(s), project component(s), and PFAS treatment technologies. As shown in Figure 2.1, there may be a number of feasible conceptual projects that could benefit one or more communities in the East Metropolitan Area. Conceptual projects were identified by the Government and 3M Working Group, the Citizen-Business Group, Subgroup 1, members of the public, and the Co-Trustees. Chapter 5 of this Conceptual Plan presents the list of potential conceptual projects that were identified. Appendix D provides additional details on the list of potential conceptual projects identified for each community.

Step 4: Develop and evaluate scenarios

As a fourth step, scenarios for the entire East Metropolitan Area were developed and analyzed for cost and technical feasibility. These scenarios consist of sets of conceptual projects and consider water supply, distribution, and demand. As shown in Figure 2.1, each scenario addresses PFAS-related drinking water quality and quantity for the 14 communities currently known to be affected by PFAS contamination in the East Metropolitan Area. Once developed, these scenarios were evaluated using the drinking water distribution and groundwater models. Timing and implementation of the scenarios were considered as part of the evaluation. Government units provided input on the refinement of scenarios. Chapter 6 of this Conceptual Plan presents the list of scenarios that were developed and evaluated. Appendices B, C, E, F and H provide additional supplemental information used for the development and evaluation of the scenarios, including an overview of the CSM, a summary of the groundwater model, detailed modeling and cost results, unit cost estimations used, a small community water system analysis, and a treatment technology comparison. Appendix G presents the detailed results of the scenario evaluations.

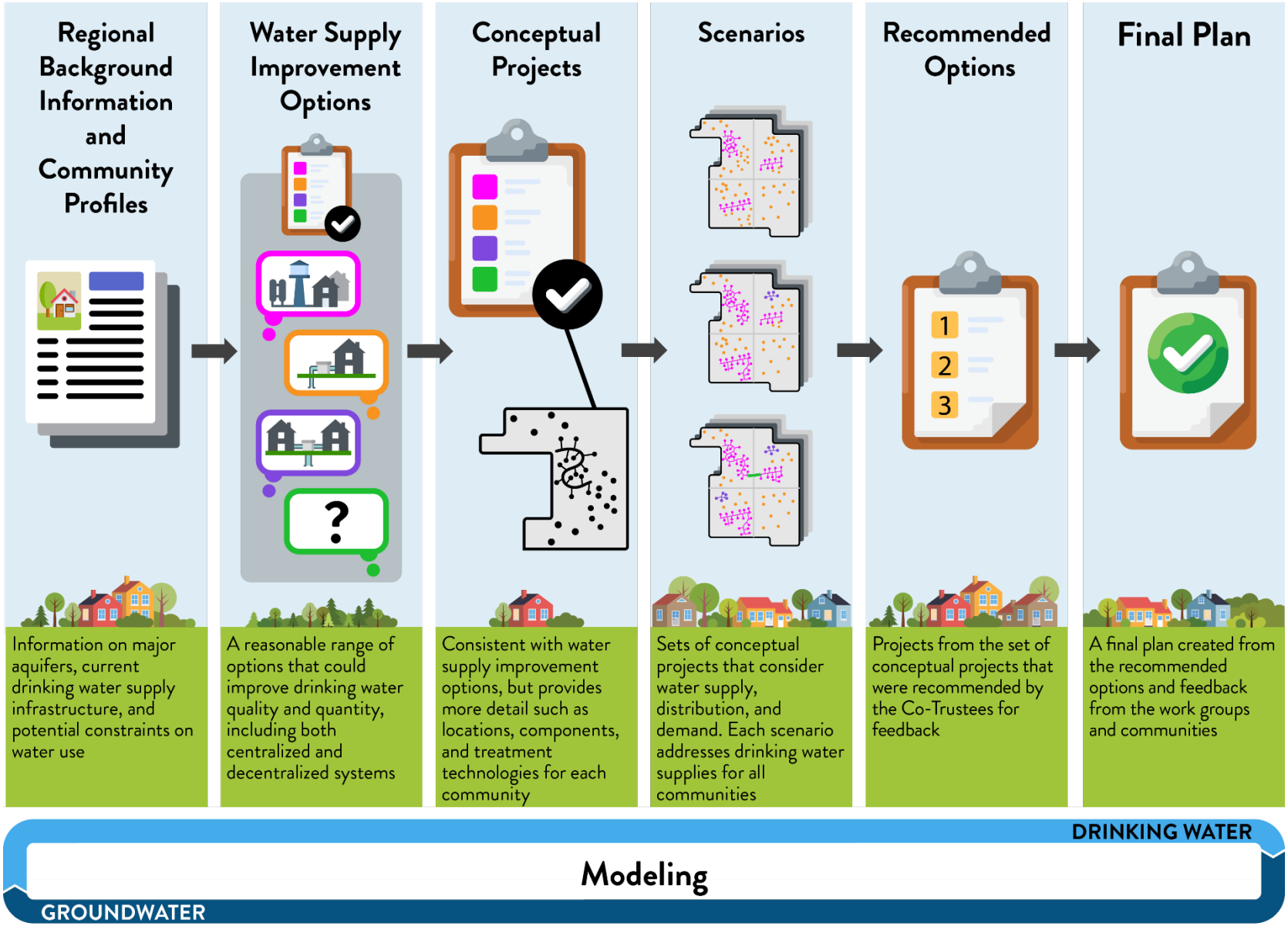
Step 5: Identify draft recommended options

As a fifth step, the scenarios were further evaluated using a set of evaluation criteria (see Chapter 6). These evaluation criteria were developed by the Co-Trustees in collaboration with the Government and 3M Working Group, the Citizen-Business Group, and Subgroup 1. Based on this evaluation, the Co-Trustees provided recommended options on the sets of projects that provide safe, sustainable drinking water to the East Metropolitan Area. Chapter 7 of this Conceptual Plan describes these three draft recommendations.

Step 6. Develop the final plan

Based on feedback gathered from the work groups and the public in response to the Draft Conceptual Plan, the Co-Trustees finalized the Conceptual Plan to provide safe and sustainable drinking water to East Metro residents. The feedback led to updated costs for the draft recommended options, which are shown in Chapter 7. Chapter 8 describes the final plan and next steps in its implementation.

Figure 2.1. Approach for the development of the Conceptual Plan.



2.2 Modeling overview

Drinking water distribution modeling and groundwater modeling were conducted to support the evaluation of scenarios as part of Step 4 (above). An overview of these two models and how they were used is provided below. Appendices B and C provide a more detailed description of the groundwater model.

2.2.1 Drinking water distribution model

Purpose

The purpose of the drinking water distribution model is to provide a comprehensive representation and understanding of the drinking water supply infrastructure in the East Metropolitan Area. This information was used to support the evaluation of each proposed scenario (Chapter 6), both within and across communities, for existing and proposed modifications to the distribution system. The modeling allows for the evaluation of the existing drinking water distribution infrastructure to achieve the following:

1. Determine whether the existing infrastructure is sufficient for any given scenario.
2. Determine where infrastructure may need to be changed to accommodate current safe drinking water supply and future demands.
3. Evaluate scenarios where multiple communities' systems are connected.

The drinking water distribution model is also a significant factor in determining the costs for each scenario. The assumptions, objectives, and development of models for a given scenario are described in greater detail in Appendix E for the updated recommended options and Appendix H for the previous scenarios and draft recommended options.

Data gathering and assessment

Individual hydraulic models were constructed for each community using data collected from the communities. Geographic information system (GIS) software was used to map each system for spatial analysis, which assisted in determining the proximity of private wells to municipal water systems and other such relative locations between infrastructure elements. GIS also allowed for the mapping of proposed infrastructure elements or modifications that could then be imported into the hydraulic modeling software. The drinking water distribution model incorporated current drinking water supply infrastructure as well as projected future infrastructure, based on each community's projected water demand through 2040, as defined in their particular water supply plan.

Available information on drinking water supply infrastructure in the 14 affected communities was received from the communities' engineers and/or consultants. The information included raw data (i.e., pumping data and demand calculations), infrastructure drawings, previous reports (e.g., studies, water supply plans, comprehensive plans, system statements), and electronic files [i.e., GIS files, existing hydraulic model files, or computer-aided design (CAD) files]. Specifically, it included:

- Number of connections, current demands, and water use
- Available water supply
- System pressures
- Existing infrastructure layouts and specific location information for municipal water systems

Private and non-community public supply well data were also assembled from the Minnesota Well Index and MPCA's PFAS sampling database.

Model development

Using the infrastructure information and data collected above, drinking water distribution models were developed for the affected communities via an iterative process, including:

1. Converting all existing model data (where available) to GIS format across all communities
2. Assigning uniform data fields for each system component type (i.e., pipes, tanks, pumps, valves, and wells) across all communities
3. Analyzing each community's data for consistency
4. Identifying missing information needed for data import
5. Collecting/verifying any missing data and assumptions
6. Importing GIS data into WaterCAD (a modeling software)
7. Establishing all base models with current infrastructure and maximum day demands
8. Calibrating the models and performing intermediate quality assurance and quality control (QA/QC)

Once the models had been established, the various scenarios were laid out within the WaterCAD software to evaluate costs and feasibility. The development of the drinking water distribution models was coordinated with the development of the groundwater model (Section 2.2.2) to identify the impacts of potential new or modified well sites. These models were reviewed by local government personnel to ensure they accurately represent current systems.

2.2.2 Groundwater modeling

Purpose

A numerical, three-dimensional groundwater flow model was developed to support the evaluation of the scenarios. The purpose of the groundwater model is to provide insight into the current groundwater flow system; predict impacts to flow paths, including existing and future wells related to PFAS contamination and transport; and assess groundwater resource availability associated with the proposed scenarios through the year 2040. The predicted impacts to existing and future wells, by PFAS movement and to groundwater quantity estimates, are based on projected groundwater recharge/precipitation rates, surface water elevations, and pumping volumes of the proposed scenarios. The year 2040 was selected because it was the time period for which there are population projections in the comprehensive plans and/or water supply plans for each community, which determine drinking water demand.

The objectives of the groundwater model are as follows:

1. Assess aquifer sustainability and viability of production rates for the proposed scenarios that may involve changes in pumping rates, or new water supply wells.
2. Analyze contaminant movement under different proposed scenarios and climate conditions to determine potential risk of PFAS contamination at existing and future wells, both municipal and private.
3. Evaluate potential impacts to groundwater resources in response to projected future groundwater use under the different proposed scenarios and climate conditions.

4. Communicate model results and technical issues (e.g., flow direction, impacts to current remediation) internally and to stakeholders through visual representations of simulated flow systems.

This groundwater model may also be used in the future to further evaluate projects as they are refined following development of this Conceptual Plan.

Notably, a flow path analysis will be performed to determine how current contamination may move over time. However, the model does not take into consideration exact concentrations or other factors in groundwater contamination movement, such as adsorption, dispersion, and degradation of chemicals, and is not considered a so called "fate and transport" model.

Data gathering and assessment

The data and content used within the groundwater model were selected in collaboration with several agencies, government units, and consultants. Major data contributors to the development of the groundwater model included the MPCA, the DNR, MDH, and the Minnesota Geological Survey (MGS). Additional contributors included local watershed districts and Washington County. The data compiled and evaluated for the groundwater model are summarized in Appendix B.

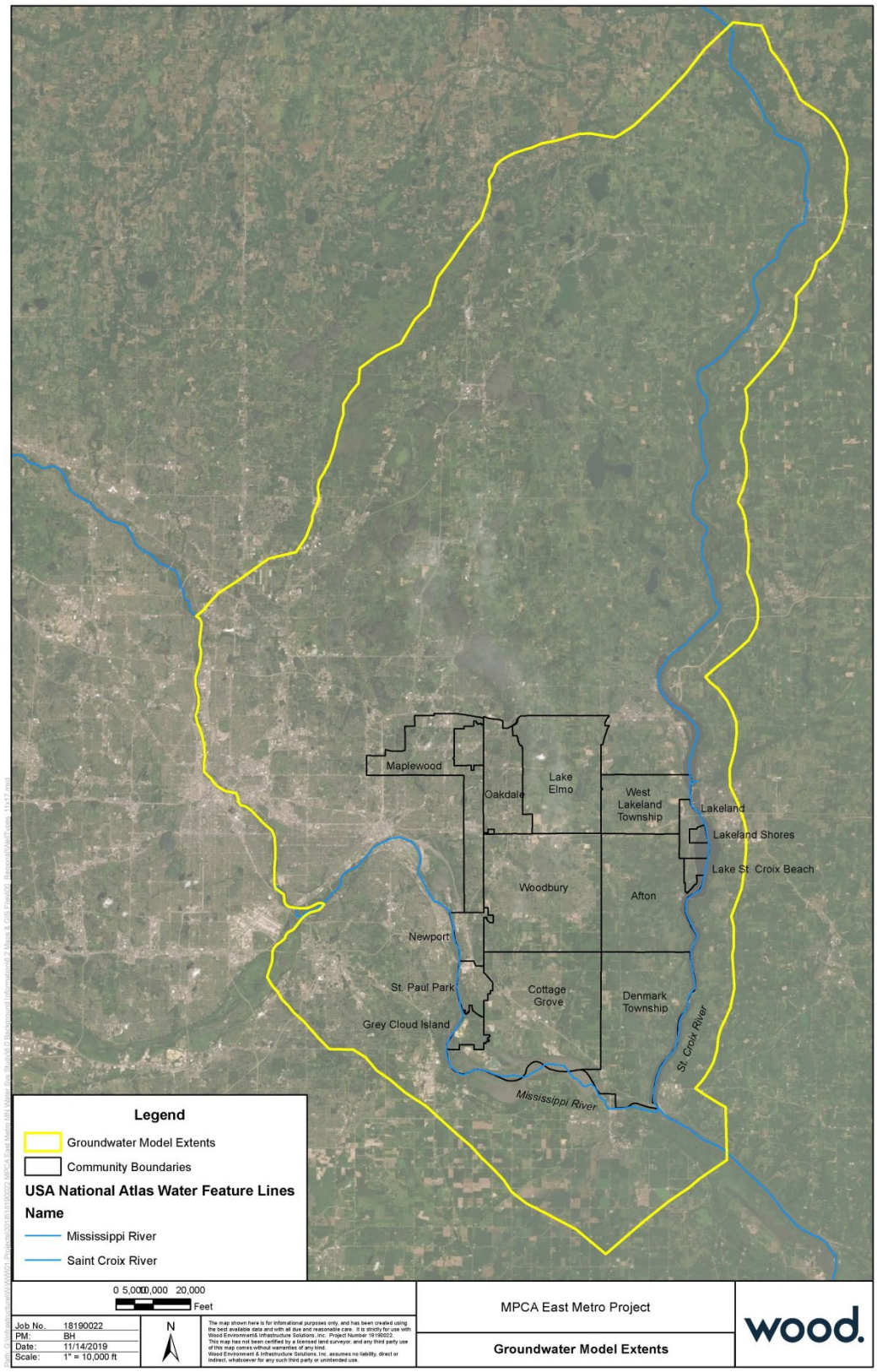
CSM development

A CSM was first developed before the numerical groundwater model for an area that includes the greater East Metropolitan Area (including the 14 affected communities as well as additional communities nearby). A CSM provides a way to better understand a very complex natural system by reducing it to a simplified set of relevant assumptions, data, and information to develop a picture of how the system functions. AECOM provided a third-party, independent review of the CSM. The CSM served as the basis for input parameters used in the numerical groundwater model, and more information on the model is included in Appendix B.

Numerical model development and review

The numerical model was built using data compiled during the CSM development. As with the CSM, the numerical model was peer reviewed by AECOM. The final domain of the completed model is presented in Figure 2.2. Additional details on the numerical model development are provided in Appendix C.

Figure 2.2. Numerical groundwater model domain boundary.



3. Background

This chapter provides background information on the East Metropolitan Area that helps lay the groundwork for this Conceptual Plan. Section 3.1 discusses the groundwater and surface water in the region, the PFAS contamination in the East Metropolitan Area, and constraints on water use. Section 3.2 discusses water supply profiles for each affected community in the East Metropolitan Area.

3.1 Regional overview

3.1.1 Groundwater

The geology of Washington County was formed over the course of several hundred million years. The basement bedrock units of Mt. Simon and Hinckley are discussed in detail in the Metropolitan Council's 2014 report, "Twin Cities Metropolitan Area Groundwater Flow Model Version 3.0" (Metropolitan Council, 2014b). During the Cambrian and Ordovician Periods of the Paleozoic Era (about 500 to 450 million years ago), rising and falling marine seas left behind layers of sedimentary rock, including carbonate, sandstone, and shale (Bauer, 2016). These bedrock layers were typically deposited horizontally; however, over time, some of these layers shifted from the earth's movement via folding, fracturing, and/or faulting. More recently, during the Quaternary Period (beginning 2.6 million years ago), a series of advancing and retreating glaciers carved the land and deposited unconsolidated clay, silt, sand, and gravel on top of these bedrock formations (Bauer, 2016).

Bedrock formations are a main factor governing groundwater in the region. Groundwater can move rapidly and in large quantities through some bedrock types, such as sandstone and fractured carbonates (i.e., limestone and dolostone), which act as aquifers (Bauer, 2016). Other rocks, such as siltstone and shale, have low permeability, serving as aquitards that impede vertical flow between aquifers (Bauer, 2016). A brief description of major hydrostratigraphic components found in the complete stratigraphic sequence is presented in Table 3.1 and Figure 3.1.

In Washington County, there are six bedrock aquifers, including the (1) St. Peter Sandstone, (2) Prairie du Chien Group including the Shakopee Formation (aquifer) and Oneota Dolomite (aquitard), (3) Jordan Sandstone, (4) Tunnel City Group including the Upper Tunnel City aquifer, (5) Wonewoc Sandstone, and (6) Mt. Simon Sandstone (Table 3.1 and Figure 3.1). These aquifers occur at different depths, and vary in thickness, porosity, permeability, and water quality. The Prairie du Chien (Shakopee Formation) and Jordan aquifers are the shallowest major bedrock aquifers, and the principal groundwater sources for drinking water used by municipalities and private well owners in Washington County (Washington County, 2014). The Wonewoc aquifer is used as a drinking water source in areas of Washington County where the Prairie du Chien (Shakopee Formation) and Jordan aquifers are absent or unusable (Washington County, 2014). The Mt. Simon aquifer is another productive aquifer, but Minnesota Statute restricts the use of this aquifer in some areas (see Section 3.1.4.2).

Table 3.1. Washington County bedrock aquifers and aquitards. Information adapted from Figure 1, Plate 2 of the Geologic Atlas of Washington County (Bauer, 2016).

Name	Hydrologic function	Sediment type	Thickness (feet)
Decorah, Platteville, and Glenwood	Aquitards	Shale, limestone, and dolostone	0–70
St. Peter Sandstone	Aquifer	Sandstone	0–160
Prairie du Chien Group: Shakopee Formation Oneota Dolomite	Aquifer	Dolostone and sandstone	0–200
Jordan Sandstone	Aquifer	Sandstone	0–100
St. Lawrence Formation	Aquitard	Siltstone, sandstone, and shale	0–45
Tunnel City Group: Mazomanie Formation Lone Rock Formation	Aquifer Upper Aquitard Lower	Sandstone, siltstone, and shale	0–180
Wonewoc Sandstone	Aquifer	Sandstone	0–60
Eau Claire Formation	Aquitard	Sandstone, siltstone, and shale	0–100
Mt. Simon Sandstone	Aquifer	Sandstone	200–280

The major aquifers are separated by three bedrock features that function as major aquitards, including the (1) Decorah Platteville Glenwood (uppermost bedrock), (2) St. Lawrence Formation (below the Jordan aquifer), and (3) Eau Claire Formation (below the Wonewoc aquifer [Table 3.1 and Figure 3.1; Washington County, 2014]). However, in some parts of the East Metropolitan Area, variations in porosity and permeability, and disruption by structures such as faults, fractures, and incised valleys, may significantly reduce the ability of these formations to impede the downward movement of groundwater and contaminants.

Washington County sits on a groundwater divide that runs roughly longitudinally north-south through the county and is particularly pronounced in the upper bedrock aquifers down through at least the Jordan aquifer (Figure 3.2). Although groundwater flow direction and the location of the groundwater divide vary from aquifer to aquifer, on the east side of the divide, groundwater generally flows east-southeast toward the St. Croix River; and on the west side of the divide, groundwater generally flows southwest toward the Mississippi River (Figure 3.2). Locally, however, the direction of groundwater flow may be influenced by other features, such as faults, buried valleys, lakes, and streams, and by well pumping. Groundwater flow directions in the Mt. Simon aquifer in the region are controlled primarily by well pumping (Sanocki et al., 2008). The major groundwater discharge zones in the county are the St. Croix and Mississippi Rivers (Washington County, 2014).

Figure 3.1. Cross-section showing Washington County bedrock aquifers and aquitards. Cross-section goes west to east from Maplewood to West Lakeland Township/Lakeland. Figure adapted from Berg (2019).

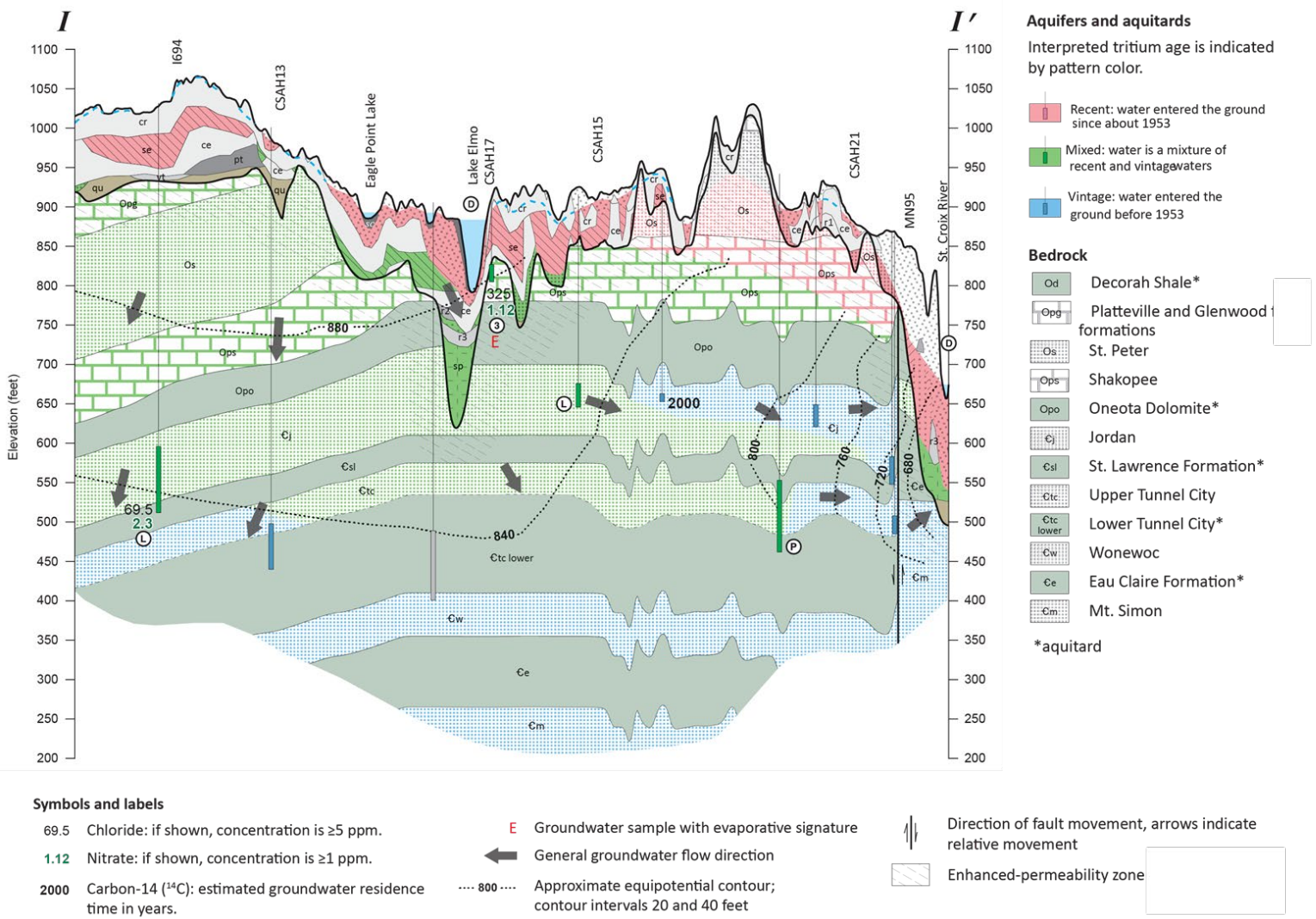
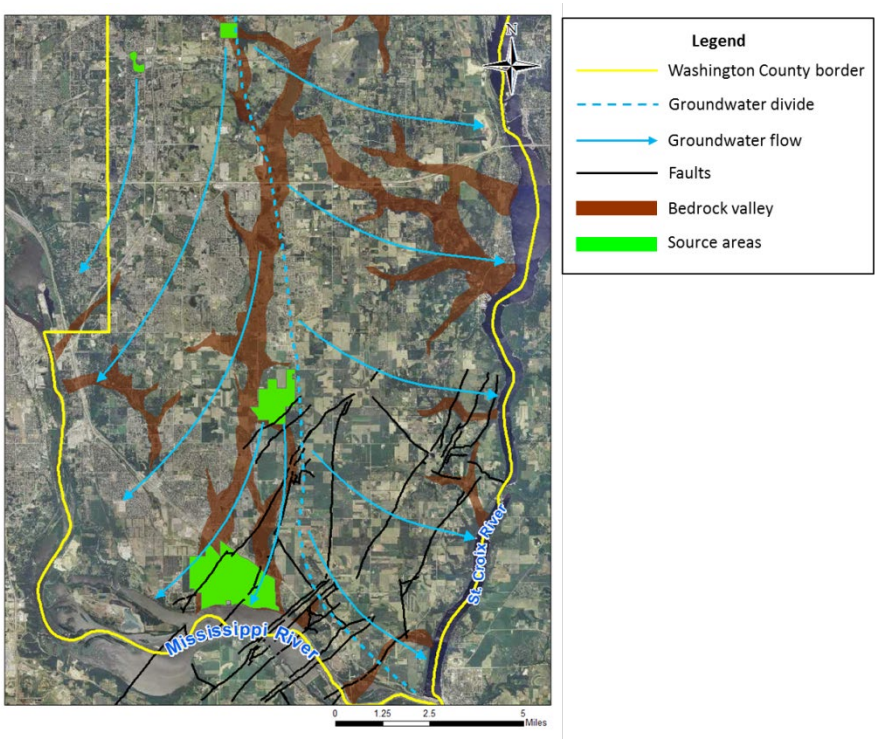


Figure 3.2. General groundwater flow in Washington County.



3.1.2 Surface water

Southern Washington County is bounded by the Mississippi River to its south and the St. Croix River to its east (Figure 3.2). Other surface water features in Washington County include lakes, rivers, streams, creeks, and wetlands. Many of these surface water features are in hydraulic connection with groundwater. For example, lakes may be a source of recharge to groundwater, an area of groundwater discharge, or both (Washington County, 2014). Likewise, streams and creeks can lose or gain water to and from the groundwater below. Many Washington County creeks that are primarily supplied by groundwater discharge are suitable for brook trout and brown trout (Washington County, 2014). Notably, not all surface water features in Washington County serve as recharge or discharge to groundwater; some are instead separated from the groundwater by a confining layer (Washington County, 2014). These water bodies are referred to as being “perched.”

3.1.3 PFAS contamination

PFAS are a family of manmade chemicals that have been used for decades to make products that resist heat, oil, stains, grease, and water. Some PFAS are extremely stable, do not break down in the environment, and are generally water-soluble. Thus, after being released from a source, these PFAS are able to enter groundwater relatively quickly and will remain in the environment without human intervention to remove them.

The State’s understanding of and ability to detect PFAS in the environment has evolved since the MPCA and MDH first began investigating the compounds in 2002. Laboratories at that time identified only a few PFAS and could not detect very low concentrations. However, method detection limits have become progressively lower over time, and the State is now able to measure extremely small amounts (parts per trillion in water) of some PFAS. Recent toxicological studies also indicate greater potential for human

health impacts from PFAS compounds than thought earlier. As the science has improved, health-based guidance values established by MDH have become progressively lower over time.

An overview of the current extent of PFAS contamination in the East Metropolitan Area and health-based guidance values are presented in the sections below.

Current extent of contamination

Since 2002, the MPCA and MDH have partnered to investigate PFAS in Minnesota. This work began with drinking water investigations near the 3M Cottage Grove plant and the 3M disposal sites in Washington County. The investigations in the East Metropolitan Area have identified an area of groundwater contamination covering over 150 square miles, affecting the drinking water supplies of over 140,000 Minnesotans. At the time of publication, over 3,800 public and private wells have been sampled in the East Metropolitan Area and 1,397 health advisories have been issued. The MPCA and MDH continue to sample nearly 1,000 private wells annually in the area to identify PFAS-impacted wells and monitor PFAS movement.

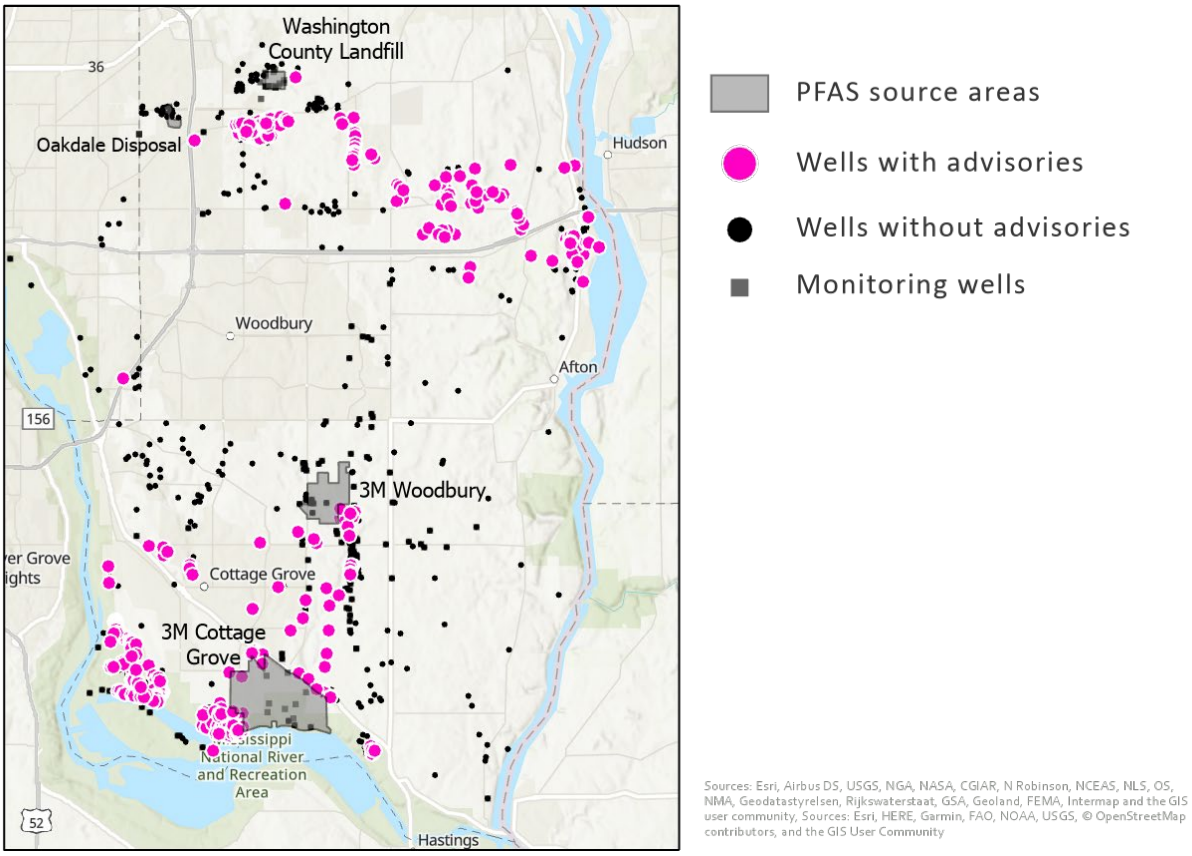
PFAS sources and movement in the East Metropolitan Area

The 3M Cottage Grove Site, the 3M Woodbury Disposal Site, the 3M Oakdale Disposal Site, and the Washington County Landfill, where 3M disposed of PFAS waste from approximately 1951 to 1975, released PFAS to the groundwater in the East Metropolitan Area.[1] The disposal site locations are shown in Figure 3.3. An overview of each site and PFAS movement is provided below.

3M Cottage Grove Site – 3M produced PFOA and PFOS at its Cottage Grove Plant from the late 1940s until 2002. After phasing out PFOA and PFOS, 3M continued PFAS manufacturing with PFAS replacement chemistries. 3M disposed of PFAS waste from its manufacturing process at several disposal sites on the Cottage Grove Plant property from approximately 1951 to 1980, and continues to discharge wastewater containing PFAS to the Mississippi River. Environmental testing shows that the groundwater beneath the 3M Cottage Grove Site is contaminated with PFAS. Groundwater beneath the site flows south and discharges to the Mississippi River. PFAS contamination has also been identified in river sediments near the 3M Cottage Grove Site. Fish consumption advisories exist for certain fish in Pool 2 of the Mississippi River adjacent to and downstream of the 3M Cottage Grove Site. Under terms of the 2007 Consent Order, 3M completed excavation and offsite disposal of PFAS-impacted soils/sediments, implemented an enhanced groundwater recovery and treatment process, and is required to conduct long-term groundwater and surface water monitoring, as appropriate, and implement institutional controls at the Site.

1. While these disposal sites are the primary sources of PFAS impacts in the East Metropolitan Area, which resulted in larger groundwater plumes, there may be other secondary sources of PFAS due to the many uses of products containing PFAS (i.e., firefighting foam). These secondary sources may have contributed to some localized environmental impacts from PFAS.

Figure 3.3. Current health advisories and 3M PFAS disposal sites in the East Metropolitan Area (updated September 2020). Wells tested and identified with a black circle showed no or low levels of PFAS. Wells tested and marked with a pink circle showed elevated levels of PFAS, for which the MDH issued the well owner a health advisory. In addition, public supply wells are not public information and therefore are not shown on this map.



Woodbury Disposal Site – The Woodbury Disposal Site consists of two locations used for the disposal of solid waste, industrial solvents, and acids from 3M's Cottage Grove and Saint Paul manufacturing facilities during the 1960s. 3M disposed of PFAS waste at the Woodbury Disposal Site from approximately 1960 to 1966. Between 1967 and 1973, 3M installed and operated four "barrier" groundwater pumping wells at the site to address non-PFAS contamination. 3M pumped the groundwater to the 3M Cottage Grove plant to be used as non-contact process water in its operations, and then discharged the water without treatment to the Mississippi River. In 1992, 3M entered the Woodbury Disposal Site into MPCA's Voluntary Investigation and Cleanup Program and installed a cap. In spring 2005, 3M reported to the MPCA that PFAS, including PFOA and PFOS, had been detected in the groundwater pump-out system at the Woodbury Disposal Site. Groundwater beneath the site flows south and southwest, resulting in PFAS migration toward the Mississippi River. Under terms of the 2007 Consent Order, 3M completed excavation and offsite disposal of PFAS-impacted soils/sediments, implemented an enhanced groundwater recovery and treatment process, and is required to conduct long-term ground and surface water monitoring as appropriate, and implement institutional controls at the Site.

Oakdale Disposal Site – The Oakdale Disposal Site consists of three former chemical waste dump sites that were used for waste burial, drum reclamation, and open burning of combustible materials. In 1983,

3M entered into a Consent Order with the MPCA to investigate and implement response actions to address releases of volatile organic compounds (VOCs) from the site. Groundwater sampling at the site in 2004 indicated PFAS were present in the groundwater monitoring wells. 3M disposed of PFAS waste at this site, and the PFAS have traveled from the Oakdale Disposal Site both south and southeast in the groundwater beneath Oakdale. Because of the connections between surface water and groundwater, PFAS have also entered the surface water in Raleigh Creek, which flows eastward into the City of Lake Elmo, impacting groundwater, where it then discharges to Eagle Point Lake in the Lake Elmo Park Reserve. All fish from Lake Elmo (i.e., the lake within the City of Lake Elmo) have a "Do Not Eat" advisory issued by MDH due to PFOS contamination. Under terms of the 2007 Consent Order, 3M completed excavation and offsite disposal of PFAS-impacted soils/sediments; implemented an enhanced groundwater recovery and treatment process; and is required to conduct long-term ground and surface water monitoring as appropriate, and implement institutional controls at the site.

Washington County Landfill – In 2004, the MPCA and MDH learned that 3M disposed of PFAS waste in the former Washington County Landfill from approximately 1971 to 1974. Environmental sampling determined that PFAS in the groundwater in the City of Lake Elmo came from both the former Washington County Landfill (where PFAS waste contained primarily PFOA waste) and the Oakdale Disposal Site (where PFAS waste contained both PFOA and PFOS waste). Because of the connections between surface water and groundwater, PFAS have been found in several area surface water bodies (i.e., Eagle Point Lake, Lake Elmo, Sunfish Lake, and Horseshoe Lake). As the MPCA Closed Landfill Program is obligated to conduct appropriate response actions in response to PFAS releases from the Washington County Landfill, waste was consolidated into a triple-liner system as the remedy at the direction of the State Legislature. In addition, under the terms of the 2007 Consent Order, 3M agreed to provide up to $8 million toward the triple-liner system.

For all four of these 3M PFAS waste disposal sites, the MPCA conducts long-term monitoring of residential wells and installs/maintains granular activated carbon (GAC) systems in private residential homes as appropriate.

Future mobility

The MPCA and MDH continue to monitor and track movement of PFAS in the East Metropolitan Area. Over time, PFAS will continue to move down-gradient as they are transported with groundwater and/or surface water. However, the future extent and movement of PFAS are uncertain. A number of factors affect PFAS movement, including the relative solubility of PFAS, local bedrock features, well pumping, and future water use, among others.

State and federal guidance for PFAS

Although knowledge of PFAS science has been in existence for more than half a century, knowledge of health-related impacts from PFAS exposure has evolved significantly over the past 20 years. The State and the U.S. federal government continue to research these substances and provide guidance to the public. Below, information is presented on MDH's drinking water guidance and the United States Environmental Protection Agency's (EPA) current role in PFAS regulation.

MDH's health based values and health risk limits

HBVs and HRLs are developed by toxicologists at MDH using the best peer-reviewed science and public health policies available at the time of their development. An HBV or HRL is the level of a contaminant that can be present in water and pose little or no health risk to a person drinking that water. The guidance values apply to short periods of time as well as over a lifetime of exposure. HBVs and HRLs are

developed to protect sensitive populations, such as infants and children, and highly exposed populations.

HBVs and HRLs are both considered guidance values, but have undergone different levels of review. HRLs have been through the Minnesota rule-making process, which includes at least one public comment period for stakeholders to provide feedback on proposed guidance values. HBVs, on the other hand, have not been promulgated using the public process described by the Administrative Procedures Act (Minnesota Statutes Chapter 14). Instead, an HBV is technical guidance made available by MDH. These values may be used by the public, risk managers, and other stakeholders to assist in evaluating potential health risks to humans from exposures to a chemical.

In 2002, MDH developed drinking water guidance values for PFOS and PFOA. Since then, MDH continues to review available toxicological information for all PFAS and develop new or revised values. Currently, MDH has guidance values for perfluorobutane sulfonate (PFBS), PFBA, perfluorohexane sulfonate (PFHxS), PFOS, and PFOA (Table 3.2). MDH continues to monitor the growing body of science about PFAS, and will adjust its guidance values as needed.

Table 3.2. Minnesota's drinking water guidance values for PFAS (as of 5/18/2021).

PFAS	Drinking water guidance value (parts per trillion)	Type of guidance value
PFBS	2,000	HBV
PFBA	7,000	HRL
PFHxS	47	HBV
PFOS	15	HBV
PFOA	35	HRL

Since water samples often contain multiple chemicals, there is the possibility that chemicals in combination may cause effects that would not be predicted based on separate exposures to individual chemicals. Therefore, when drinking water contamination involves multiple PFAS chemicals for which guidance values are available and that share a common health endpoint, MDH evaluates their "additive" risk, and calculates an health risk index (HRI or health index, HI, used interchangeably throughout) to determine whether the combined health risk exceeds a certain level. The HI is determined by calculating the concentration of each chemical divided by its HRL or HBV, and adding the resulting ratios. A HI equal to or greater than one indicates a possible health risk from a group of PFAS chemicals that share a common health endpoint. For more information, visit the MDH's webpage on evaluating concurrent exposures to multiple chemicals (https://www.health.state.mn.us/communities/environment/risk/guidance/gw/additivity.html).

EPA's role in PFAS

At the federal level, the EPA establishes drinking water standards and provides guidance to ensure safe drinking water for public water supplies. Among other roles, EPA is responsible for establishing:

- Maximum contaminant levels (MCLs): MCLs are drinking water standards for public water supplies. States are allowed to enforce lower (i.e., stricter) standards than MCLs, but are not allowed to enforce higher (i.e., less strict) standards. MCLs are established through a scientific process that evaluates health impacts of the contaminant and the technology and cost required for the prevention, monitoring, and/or treatment. New MCLs or changes to existing MCLs are infrequently made.

- EPA Health Advisory Levels (HALs). HALs provide technical guidance to EPA and other public health officials, but are not enforceable water quality standards. HALs are based on non-cancer health effects for different lengths of exposure (i.e., 1 day, 10 days, or lifetime).

In 2016, EPA released HALs for PFOA and PFOS to reflect the latest scientific evidence about the risk posed by PFAS. MDH's current guidance values for PFOA and PFOS (35 parts per trillion for PFOA and 15 parts per trillion for PFOS) are more protective than the EPA value of 70 parts per trillion for either chemical or when added together. While the EPA value is protective for most people, it does not address the potential for mothers to pass along the chemicals to fetuses and nursing infants. The updated MDH values reflect new state-level analyses of existing and new scientific literature that resulted in the calculation of more-protective guidance values to protect mothers from passing along the chemicals to fetuses and nursing infants.

In February 2019, EPA released a PFAS Action Plan (EPA, 2019). This Conceptual Plan describes EPA's approach to identifying and understanding PFAS, addressing current PFAS contamination, preventing future contamination, and effectively communicating with the public about PFAS (EPA, 2019). Key actions EPA identified include:

- Initiating steps to evaluate the need for a maximum contaminant level (MCL) for PFOA and PFOS
- Beginning the necessary steps to propose designating PFOA and PFOS as "hazardous substances" through one of the available federal statutory mechanisms (e.g., Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); Clean Water Act; Resource Conservation and Recovery Act (RCRA))
- Developing groundwater cleanup recommendations for PFOA and PFOS at contaminated sites
- Developing toxicity values or oral reference doses for GenX chemicals (a replacement for PFOA) and PFBS
- Developing new analytical methods and tools for understanding and managing PFAS risk
- Promulgating Significant New Use Rules that require EPA notification before chemicals are used in new ways that may create human health and ecological concerns
- Using enforcement actions to help manage the risks of PFAS, where appropriate (EPA, 2019)

3.1.4 Groundwater use

Groundwater is the main source of drinking water for the communities in the East Metropolitan Area. Below, information is presented on the management of groundwater resources (see Management of groundwater resources), and potential constraints and issues with groundwater use (see Groundwater use constraints and issues).

Management of groundwater resources

The DNR is responsible for managing the use of groundwater in Minnesota (Minnesota Rules Chapter 6115 and Minnesota Statutes Chapter 103G). A DNR permit is required for appropriations of more than 10,000 gallons per day or 1 million gallons per year. The DNR is also mandated by statute to ensure the sustainability of water resources. The sustainability standard described in Minnesota Statutes § 103G.287, subd. 5, is as follows:

> The commissioner may issue water-use permits for appropriation from groundwater only if the commissioner determines that the groundwater use is sustainable to supply the needs of future generations and the proposed use will not harm ecosystems, degrade water, or reduce water levels beyond the reach of public water supply and private domestic wells constructed according to Minnesota Rules, chapter 4725.

The DNR has statutory authority to designate groundwater management areas (Minnesota Statutes § 103G.287, subd. 4). Washington County, along with Ramsey County and portions of Anoka and Hennepin counties, fall within the North and East Metropolitan Groundwater Management Area. Within these areas, the DNR may limit total annual water appropriations and uses to ensure sustainable use of groundwater that protects ecosystems, water quality, and the ability of future generations to meet their own needs (Minnesota Statutes § 103G.287, subd. 4). The DNR also monitors groundwater levels and has an extensive observation well network in the county (Washington County, 2014).

Watershed districts also have the authority to protect groundwater and regulate its use to preserve it for beneficial purposes (Minnesota Statutes § 103D.201, subd. 2(14)). However, none of the watershed districts in Washington County currently use their authority to regulate groundwater (Washington County, 2014).

Groundwater use constraints and issues

Groundwater availability and use in the region are affected by groundwater withdrawals, recharge rates, areas of contamination, and other constraints. Below are some specific factors that affect the availability of groundwater use for drinking water supply.

Population growth and land use changes

The population of Washington County is expected to grow by 32% between 2015 and 2040 (Washington County, 2018). Even with improved water conservation and efficiency, this growth is expected to increase groundwater withdrawals to serve the changing residential, commercial, agricultural, and industrial needs of the county (Washington County, 2014). While the region's aquifers have been able to serve current populations, increased pumping may reduce the overall quantity. In addition, new development typically increases the amount of impervious surfaces (e.g., roads, buildings) and compacts the soil, which may further reduce the infiltration of water into the aquifer (Washington County, 2014). A study conducted by the Metropolitan Council in 2016 found that approximately 13,000 acres of good recharge potential and 49,000 acres of limited recharge potential are mostly located in the eastern and southern portions of their study area, including the communities of Afton, Cottage Grove, Denmark Township, and West Lakeland Township (Metropolitan Council, 2016a).

Aquifer contamination

Groundwater contamination in the East Metropolitan Area further reduces the amount of groundwater that is available for drinking water supply, unless properly treated. As discussed in Section 3.1.3, a portion of groundwater in the East Metropolitan Area is contaminated with PFAS. In addition, groundwater in portions of the area is also contaminated with VOCs, such as trichloroethylene (TCE), from industrial sites, and nitrates from the use of fertilizers for agriculture and landscaping, among other contaminants (Washington County, 2014).

Pollution containment

The 3M Woodbury Site has four groundwater barrier wells to contain PFAS-impacted groundwater on site. These barrier wells pump approximately 4 million gallons of groundwater per day for pollution containment. The groundwater pumped from the 3M Woodbury barrier wells is piped to the 3M Cottage Grove facility, which, along with production wells for the plant and groundwater pump-out wells that contain PFAS-impacted groundwater at the 3M Cottage Grove Site, is treated with GAC prior to use at the plant. Once used for plant production or non-contact cooling water, the water is once again treated with carbon as part of the plant's wastewater treatment system before discharge to the

Mississippi River. PFAS-impacted groundwater that is pumped out at the 3M Oakdale Site for pollution containment is also treated with GAC before discharge to the sanitary sewer system.

Before the installation of the triple-liner system at the Washington County Landfill, a groundwater containment system was in place to control offsite migration of VOC-contaminated groundwater. This groundwater containment system consisted of a spray irrigation system to reduce VOC concentrations, before infiltration. After completion of the triple-liner system, the groundwater containment system was removed and VOC-/PFAS-impacted leachate was collected and transported to the Metropolitan Council Environmental Services (MCES) Metropolitan Wastewater Treatment Plant for disposal.

Aquifer restrictions

Minnesota Statutes § 103G.271, subd. 4a, restricts the DNR from issuing new water-use permits that will appropriate water from the Mt. Simon-Hinckley aquifer in a metropolitan county unless the appropriation is for drinking water, there are no feasible or practical alternatives, and a water conservation plan is developed and incorporated with the permit.

To date, 11 Mt. Simon wells have been sampled for PFAS. PFBA was detected in five of the wells, ranging in concentration from 8 through 27 parts per trillion. MDH's HRL for PFBA is currently 7,000 parts per trillion.

Special Well and Boring Construction Area

A Special Well and Boring Construction Area (SWBCA) is a mechanism that provides for controls on the drilling or alteration of public and private water supply wells and environmental wells in an area where groundwater contamination has resulted in, or may result in, risks to public health. Minnesota Rules 4725.3650, Subpart 1, provides that "[w]hen the commissioner designates an area where contamination is detected as a special well and boring construction area, a well or boring must not be constructed, repaired, or sealed until the commissioner has reviewed and approved a proposed plan submitted by the installer. Sealing, repair, construction, and location must comply with the approved plans." Thus, consistent with this rule, contractors and property owners must submit a written request and a well construction plan to MDH's Well Management Section, and must receive written approval before construction, repair, or sealing of a well in an SWBCA. In addition, before signing an agreement to sell or transfer property in Washington County that is not served by a municipal water system, the seller must state in writing to the buyer whether the property is located within an SWBCA (Minnesota Statutes § 103I.236).

In Washington County, all or portions of the following communities have SWBCAs in effect: Bayport, Baytown Township, Lake Elmo, Lakeland, Lakeland Shores, Newport, Oakdale, St. Paul Park, and West Lakeland Townships.

Sustainability standard

As discussed in Section 3.1.4.1, the DNR may only issue water-use permits for groundwater appropriations if groundwater use is sustainable to supply the needs of future generations and will not harm ecosystems, degrade water, or reduce water levels (Minnesota Statutes § 103G.287, subd. 5). This mandate may limit the water-use permits that can be issued in an area. Minnesota Administrative Rules 6115.0630 (Definitions) defines "safe yield" as "the amount of groundwater that can be withdrawn from an aquifer system without degrading the quality of water in the aquifer." For water-table (unconfined) aquifers, this rule further indicates that safe yield does not allow "the long term average withdrawal to exceed the available long term average recharge to the aquifer system based on representative climatic conditions." For confined aquifers, the rule indicates that there cannot be a "progressive decline in

water pressures and levels to a degree which will result in a change from artesian condition to water table condition."

3.1.5 Surface water use

Surface water is another source of drinking water for some communities in the Twin Cities. St. Paul Regional Water Services (SPRWS) uses water from the Mississippi River to provide drinking water to St. Paul and the surrounding communities, including Maplewood. SPRWS also maintains a series of groundwater wells from the Prairie du Chien-Jordan aquifer as a backup supply system. The City of Minneapolis also relies on the Mississippi River as a source of water.

Below, information is presented on the management of surface water resources (See Management of surface water resources) and potential constraints and issues with surface water use (see Surface water use constraints and issues).

Management of surface water resources

The DNR regulates the appropriation of water from surface water bodies, including streams, rivers, and lakes. Regarding streams and rivers (termed "watercourses"), Minnesota Statutes § 103G.285, subd. 2, states: "[i]f data are available, permits to appropriate water from natural and altered natural watercourses must be limited so that consumptive appropriations are not made from the watercourses during periods of specified low flows." Regarding lakes (termed "water basins"), Minnesota Statutes § 103G.285, subd. 3(a), states that: "[p]ermits to appropriate water from water basins must be limited so that the collective annual withdrawals do not exceed a total volume of water amounting to one-half acre-foot per acre of water basin." There would also be federal requirements associated with appropriating water from the St. Croix River and the Mississippi River. See a further discussion on restrictions for the St. Croix River National Scenic Riverway below.

Surface water use constraints and issues

Below are some specific factors that affect the availability of surface water for drinking water supply.

St. Croix River

The St. Croix River, with its headwaters in Wisconsin, flows along the east side of Washington County until it joins with the Mississippi River just southeast of Denmark Township. The St. Croix River watershed encompasses over 7,000 square miles, with approximately 46% of the watershed in Minnesota (MPCA, 2019).

The St. Croix River is federally protected as a National Scenic Riverway. The upper 200 miles of the river is managed by the National Park Service (NPS); and the lower 52 miles of the river are under cooperative management by NPS, the Minnesota DNR, and the Wisconsin DNR. This lower designation spans from Taylors Falls, Minnesota/St. Croix Falls, Wisconsin, to the confluence with the Mississippi River at Point Douglas, Minnesota/Prescott, Wisconsin. In 2001, NPS prepared a Final Cooperative Management Plan and Environmental Impact Statement for the Lower St. Croix National Scenic Riverway to guide the management of the riverway (NPS, 2001).

As presented in the Washington County Municipal Water Coalition Water Supply Feasibility Study, current regulations do not preclude the use of water from the Lower St. Croix River. Permitting such use, however, would be very dependent on the specifics of the project, including the exact location, the amount of water to be diverted from the river, and the characteristics of structures that would be built. It would require multiple permits and review and approval from a number of agencies, potentially including state and federal environmental reviews (Metropolitan Council, 2016b).

Water flow

The Mississippi and St. Croix River water flow is influenced by multiple factors in the region, including precipitation, snowmelt, upstream water use, altered hydrology, and land use change. The water flow of the Mississippi River in St. Paul has increased by 24% over the last 70 years (NPS and Friends of the Mississippi River, 2016).

Contaminants

Surface water sources may contain elevated concentrations of contaminants due to point and non-point sources of pollution. Some contaminants of concern in the Mississippi River within the Twin Cities Metropolitan Area include nitrate, chloride, mercury, PFOS, pesticides (e.g., atrazine, acetochlor, chlorpyrifos), and pharmaceuticals (NPS and Friends of the Mississippi River, 2016).

3.2 Community water supply profiles

3.2.1 Overview

Within the East Metropolitan Area, 14 communities are currently known to be affected by PFAS contamination in their drinking water supplies. These communities include the cities of Afton, Cottage Grove, Lake Elmo, Lakeland, Lakeland Shores, Maplewood, Newport, Oakdale, St. Paul Park, and Woodbury; the townships of Denmark, Grey Cloud Island, and West Lakeland; and the Prairie Island Indian Community. All the communities are within DNR's North and East Metro Ground Water Management Area, and use the Prairie du Chien-Jordan aquifer as their primary source of drinking water (Metropolitan Council, 2016b). While many residents and businesses in the East Metropolitan Area are connected to municipal water systems, many others use private wells and one (specifically Maplewood) receives water from SPRWS.

The communities where residents and businesses rely solely on private wells are generally found on the eastern side of the East Metropolitan Area, and are typically rural residential townships with relatively smaller populations that are planned for either complete buildout (i.e., the majority of the land area is already developed) or minimal growth until 2040 (Figure 3.4). Many of these communities have groundwater contamination issues related to PFAS and/or other contaminants, which have been resolved by GAC treatment at individual residences. The MPCA and MDH continue to monitor throughout the PFAS-impacted areas of the East Metropolitan Area to evaluate potential risks to residences with private wells, and will take appropriate action to mitigate identified risks.

Communities with a combination of residents and businesses receiving drinking water from municipal water systems and private wells are generally larger and found on the western side of the East Metropolitan Area (Figure 3.5). These larger communities are commonly areas where higher growth is anticipated within the portion of the community that is designated as a Municipal Urban Service Area (MUSA) for the 2040 planning period, as indicated in the Metropolitan Council's System Statements (https://metrocouncil.org/Communities/Planning/Local-Planning-Assistance/System-Statements.aspx). Areas outside of the MUSA are not planned to be served through municipal services (e.g., public water and public sewer systems). Many of these communities have groundwater contamination issues related to PFAS. Some have already conducted evaluations and all are implementing alternative measures for providing safe drinking water to their residents to some degree, in addition to treatment at individual residences. Treatment at individual residences is work administered by the MPCA and MDH, when necessary, where there are private wells requiring treatment.

Figure 3.4. All non-municipal wells within the East Metropolitan Area. Includes private wells as well as those used for irrigation, monitoring, testing, and other applications (based on current Minnesota Well Index data).

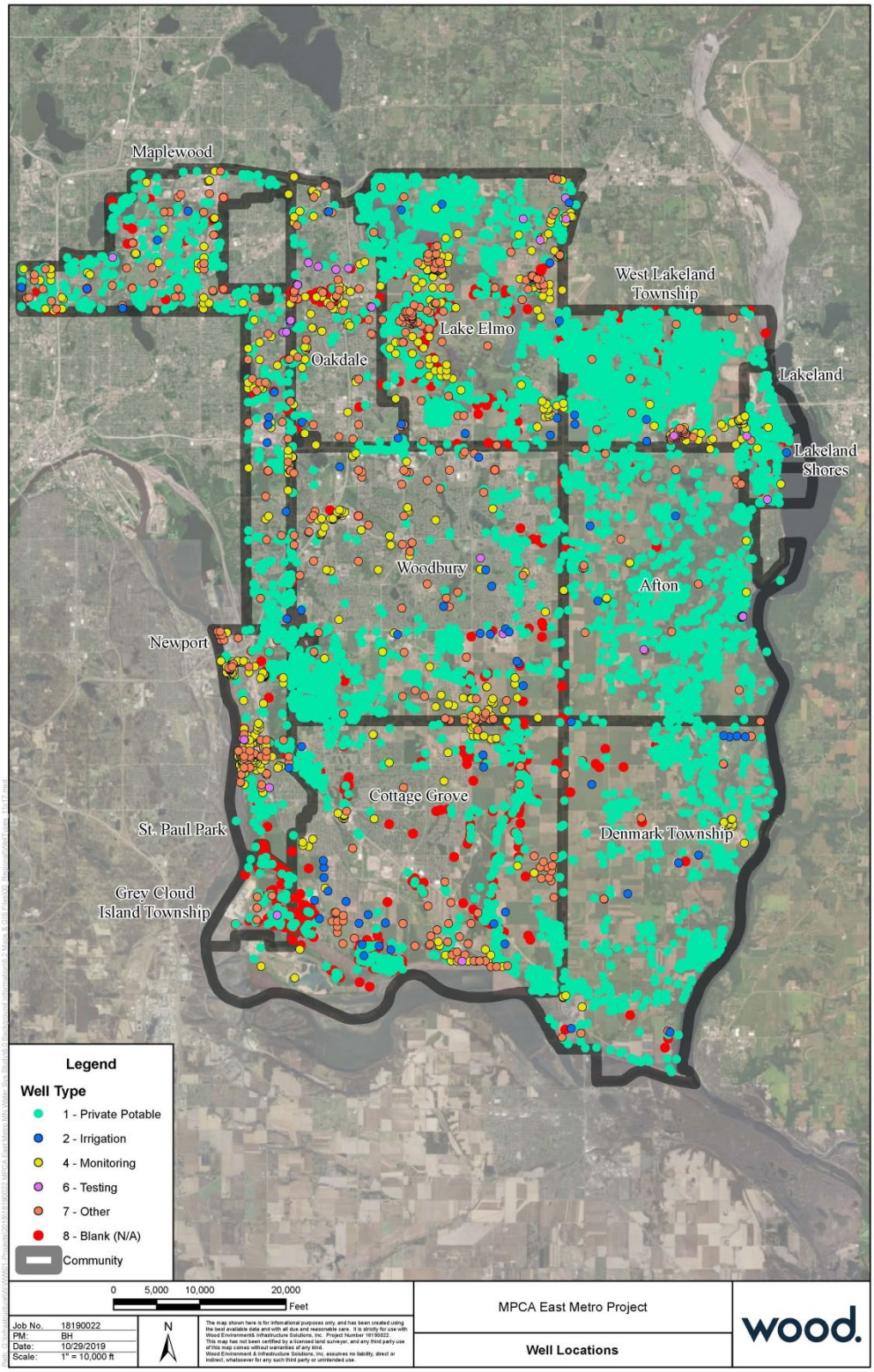
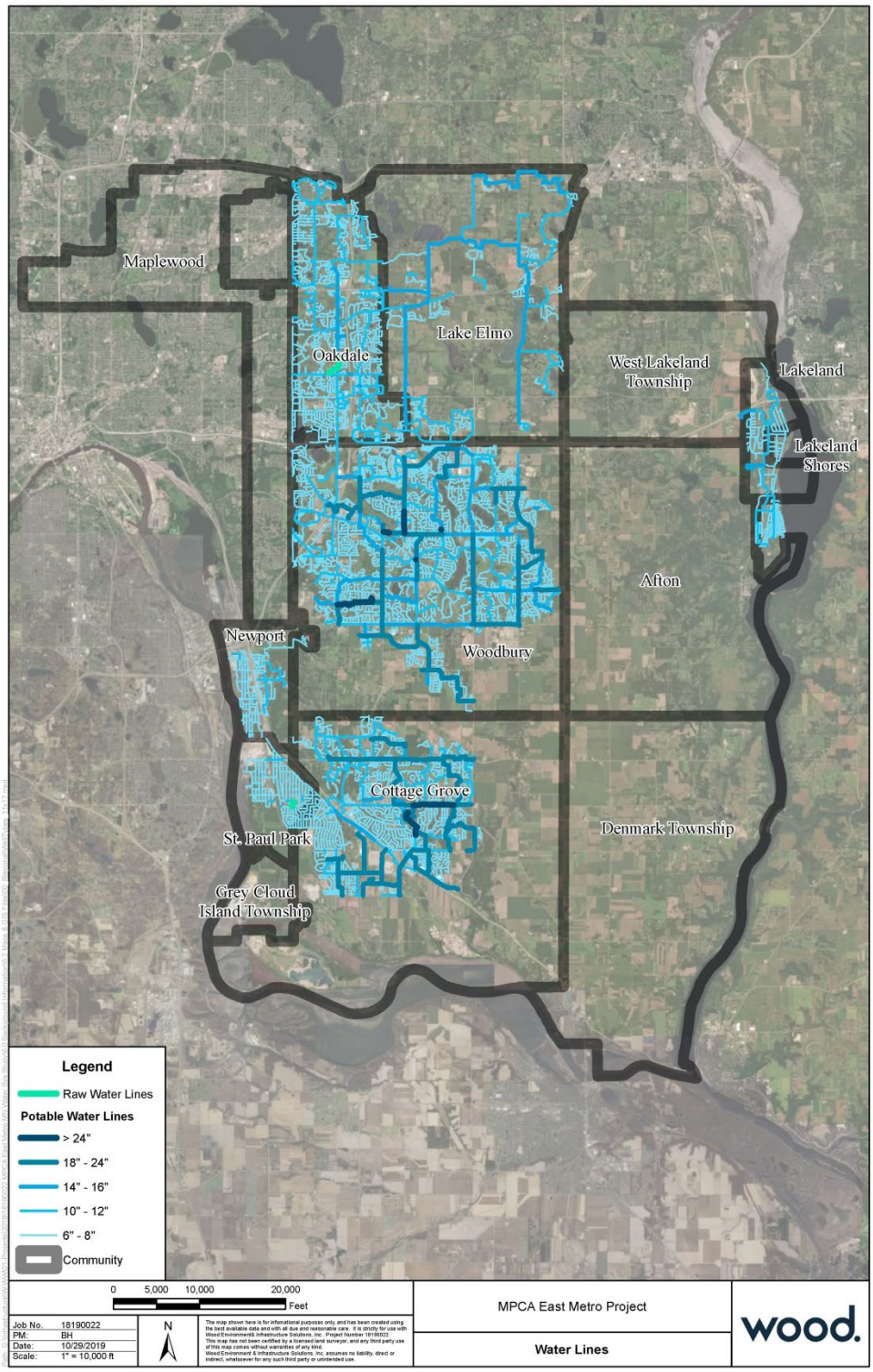


Figure 3.5. Municipal water system infrastructure (current conditions) in the East Metropolitan Area. Includes municipal water system infrastructure of Cottage Grove, Lake Elmo, Lakeland/Lakeland Shores, Newport, Oakdale, Saint Paul Park, and Woodbury. Note that Maplewood is also served by a municipal system, but is not shown.



3.2.2 Community water supply summaries

An overview of the existing water supplies and treatment systems for each of the 14 affected communities is provided below and summarized in Table 3.3. See Appendix A for more information on each community.

Table 3.3. Community water supply summaries.

Community	Drinking water source	PFAS impacts of HI > 1?	PFAS treatment	Other considerations
Afton	Private wells	Yes – northern portion	GAC treatment on private wells	None
Cottage Grove	Mixed – 12 municipal supply wells from the Prairie du Chien-Jordan aquifer and private wells	Yes – throughout	Mixed temporary GAC treatment and blending on some municipal supply wells, other wells offline; GAC treatment on private wells or connecting to the municipal supply	None
Denmark	Private wells	No	None	None
Grey Cloud Island	Private wells	Yes – throughout	GAC treatment on private wells and/or bottled water	None
Lake Elmo	Mixed – 3 municipal supply wells from the Prairie du Chien-Jordan, Jordan-St. Lawrence, and soon to be Jordan-only aquifers, and private wells	Yes – southern three-quarters of the city	GAC treatment on private wells or connecting to the municipal supply	White Bear Lake restrictions and Bayport TCE plume
Lakeland	Mixed – 2 municipal supply wells from the Mt. Simon aquifer and private wells	Yes – northern three-quarters of the city	GAC treatment on private wells or connecting to the municipal supply	Bayport TCE plume to the north
Lakeland Shores	Mixed – supplied by Lakeland municipal water system and private wells	Yes – throughout	GAC treatment on private wells or connecting to the municipal supply	None
Maplewood	Mixed – SPRWS and private wells	Yes – southern end of the city	GAC treatment on private wells	None
Newport	Mixed – 2 municipal supply wells from the Jordan-St. Lawrence aquifer and private wells	No	Connecting to the municipal supply	None
Oakdale	Mixed – 9 municipal supply wells from the Jordan-St. Lawrence aquifer and private wells	Yes – southern two-thirds of the city	GAC treatment for two affected municipal supply wells, other wells offline; GAC treatment on private wells or connecting to the municipal supply	White Bear Lake restrictions

Community	Drinking water source	PFAS impacts of HI > 1?	PFAS treatment	Other considerations
Prairie Island Indian Community	Not applicable; currently vacant land	Yes – irrigation well	None	Tribe plans to develop this land in the near future
St. Paul Park	Mixed – 3 municipal supply wells from Jordan-St. Lawrence aquifer and private wells	Yes – throughout	Temporary GAC treatment for 2 affected municipal supply wells in progress; GAC treatment on private wells or connecting to the municipal supply	None
West Lakeland	Private wells	Yes – primarily southern three-quarters of the township	GAC treatment on private wells and/or bottled water	Bayport TCE plume in the northern third of the township
Woodbury	Mixed – 19 municipal supply wells from the Jordan, Jordan-St. Lawrence, Prairie du Chien-Jordan aquifers, and private wells	Yes – primarily near central and eastern municipal supply well fields	Blending for municipal supply wells, with the addition of a temporary treatment system in 2020; GAC treatment on private wells or connecting to the municipal supply	Valley Creek Watershed in the northeastern corner of the city

Afton

Afton, located on the eastern side of the East Metropolitan Area, is a rural city designated as a Diversified Rural community by the Metropolitan Council (2014a). Afton has no municipal water system, with residents and businesses in the community on private wells. According to available data from PFAS sampling to date, the northern border of Afton is the only area of the community with PFAS levels that exceed the HI of 1. The remaining areas of the community that have been sampled to date have detectable levels of PFAS but do not meet or exceed the HI of 1. Treatment has been provided for individual residences that have received health advisories.

Cottage Grove

Cottage Grove, located on the southwestern side of the East Metropolitan Area, is designated as a Suburban Edge community by the Metropolitan Council (2014a). Cottage Grove has a municipal water system as well as residences on private wells. To date, 8 out of Cottage Grove's 12 municipal supply wells exceed the HI of 1. Of those, two have been taken offline, two receive temporary GAC treatment, and one is used for blending if needed. Cottage Grove's population is expected to increase – the city would likely need an additional municipal supply well to meet projected water demands through 2040. According to available data from PFAS sampling to date, many of the non-municipal wells in Cottage Grove exceed the HI of 1. Treatment has been provided for individual residences that have received health advisories.

Denmark

Denmark, located on the southeastern side of the East Metropolitan Area, is a rural township designated as a Diversified Rural community by the Metropolitan Council (2014a). Denmark has no municipal water

system, with residents and businesses in the community on private wells. According to available data from PFAS sampling to date, one non-municipal well in the community had PFAS levels that exceeded the HI of 1. However, according to MDH, this well was located on an old farm that was sampled just before being sealed; therefore, no health advisory was issued for the well. The remaining areas of the community that have been sampled to date have detectable levels of PFAS but do not meet or exceed the HI of 1.

Grey Cloud Island

Grey Cloud Island, located on the southwestern side of the East Metropolitan Area, is a small rural township designated as a Diversified Rural community by the Metropolitan Council (2014a). Grey Cloud Island has no municipal water system, with residents and businesses in the community on private wells. According to available data from PFAS sampling to date, Grey Cloud Island has detectable levels of PFAS in the majority of its non-municipal wells and PFAS exceeding the HI of 1 in many of them. Treatment and/or bottled water has been provided for individual residences that have received health advisories.

Lake Elmo

Lake Elmo, located on the northern side of the East Metropolitan Area, is designated as an Emerging Suburban Edge and Rural Residential community by the Metropolitan Council (2014a). Lake Elmo has a municipal water system as well as residences on private wells. Currently, Lake Elmo has two municipal supply wells in use and a third being installed to meet the city's current water needs; however, these wells are unlikely to meet projected water demands through 2040. In addition, one municipal supply well exceeded the HI of 1 and has been sealed; and another well was installed but never used due to contamination issues. One of the municipal supply wells also falls within a five-mile radius of White Bear Lake, which has legal implications for the city's appropriation permits and future growth. According to available data from PFAS sampling to date, a substantial number of non-municipal wells exceed the HI of 1. Treatment has been provided for individual residences that have received health advisories.

Lakeland and Lakeland Shores

Lakeland and Lakeland Shores, located on the eastern side of the East Metropolitan Area, are designated as Rural Residential communities by the Metropolitan Council (2014a). Lakeland has a municipal water system that serves a large fraction of the community, and also serves Lakeland Shores and Lake St. Croix Beach. Lakeland has two municipal supply wells to meet the city's current and projected water demands through 2040. At this time, neither municipal supply well has exceeded the HI of 1. A number of residences are on private wells, and, according to available data from PFAS sampling to date, many exceed the HI of 1. Treatment has been provided for individual residences that have received health advisories and the city continues to connect residents to their municipal supply as a long-term measure.

Maplewood

Maplewood, located on the northwestern side of the East Metropolitan Area, is designated as an Urban community by the Metropolitan Council (2014a). The community is primarily supplied drinking water by the private utility provider, SPRWS, which uses a series of surface water bodies (primarily the Mississippi River and a series of lakes) as its source water. Some residences are on private wells throughout the community, particularly in the southern portion. According to available data from PFAS sampling to date, some of these private wells exceed the HI of 1. Treatment has been provided for individual residences that have received health advisories.

Newport

Newport, located on the southwestern side of the East Metropolitan Area, is designated as an Urban community by the Metropolitan Council (2014a). The majority of the community is currently served by the city's municipal water system, with the exception of a few residences and neighborhoods on private wells. Newport has two municipal supply wells with sufficient capacity to meet the city's current and projected water demands through 2040. At this time, neither the municipal supply wells nor non-municipal wells meet or exceed the HI of 1. The city does not currently have any established interconnects with neighboring communities to provide backup water supply if needed.

Oakdale

Oakdale, located on the northern side of the East Metropolitan Area, is designated as a Suburban community by the Metropolitan Council (2014a). The majority of the community is currently served by the city's municipal water system, with the exception of some residences and neighborhoods on private wells. Oakdale's municipal water system has nine municipal supply wells to meet the city's water demands; however, many have been taken offline due to PFAS contamination and other water quality issues. Of their seven active municipal supply wells, the city currently relies primarily on four wells, two of which are routed through a centralized GAC treatment facility. The other two wells currently used for water supply are located in the northern portion of Oakdale and have very low HI values. The four wells currently in use have sufficient capacity to meet current water demands, but will not be sufficient to meet projected water demands through 2040. Three of the remaining wells could be used, but require treatment for PFAS. According to available data from PFAS sampling to date, a number of non-municipal wells exceed the HI of 1. Treatment has been provided for individual residences that have received health advisories. Some of Oakdale's wells are within a five-mile radius of White Bear Lake, which has legal implications for the city's appropriation permits and future growth.

Prairie Island Indian Community

The Prairie Island Indian Community is located in Goodhue County, Minnesota; however, the community owns 111 acres of undeveloped land in West Lakeland Township. The property in West Lakeland is currently undeveloped, but the Prairie Island Indian Community has submitted an initial site plan indicating a proposed 71 residential lots and approximately 12 acres for commercial development. An irrigation well within the property exceeds the HI of 1 and has been evaluated for conversion to a potable water supply well to supply the future development.

St. Paul Park

St. Paul Park, located on the southwestern side of the East Metropolitan Area, is designated as an Emerging Suburban Edge community by the Metropolitan Council (2014a). The majority of the community is currently served by the city's municipal water system, with the exception of some residences in the central and western portion of St. Paul Park on private wells. St. Paul Park's municipal water system consists of three municipal supply wells with sufficient capacity to meet the city's current and projected water demands through 2040. To date, two of the municipal supply wells had PFAS concentrations that exceeded the HI of 1. As a result, the city relies primarily on one well, with minimal water being supplied from the other two. A temporary treatment system was installed in 2020 as an interim measure pending the final Conceptual Plan. According to available data from PFAS sampling to date, a substantial number of the non-municipal wells also exceed the HI of 1. Treatment has been provided for individual residences that have received health advisories, or residents have been connected to city water.

West Lakeland

West Lakeland, located on the northeastern side of the East Metropolitan Area, is a rural township designated as a Rural Residential community by the Metropolitan Council (2014a). West Lakeland has no municipal water system, with residents and businesses in the community on private wells. West Lakeland has been faced with contamination issues from PFAS and TCE. The northern portion of the community has TCE groundwater contamination from the Baytown Township National Priorities List Site. In addition, recent sampling efforts have indicated that groundwater in the southern portion of the community is contaminated with PFAS. Many homes already have GAC treatment systems in place because of actions taken following the earlier TCE contamination issue, and many additional GAC systems have been installed in response to PFAS health advisories. Residences in the southern portion without GAC treatment systems already installed are being provided bottled water until these individual systems can be installed.

Woodbury

Woodbury, located on the western side of the East Metropolitan Area, is designated as a Suburban Edge community by the Metropolitan Council (2014a). The majority of the community is currently served by the city's municipal water system, with the exception of some residences on private wells, primarily located in the southern third of the city. Woodbury has 19 municipal supply wells to meet its current water demands, and it is anticipated that 5 additional wells will be required to meet the city's projected water demands through 2040. To date, seven municipal supply wells have received a health advisory. Some of the impacted wells are currently used for blending. A temporary treatment system was installed in 2020 as an interim measure pending the final Conceptual Plan. According to available data from PFAS sampling to date, a few non-municipal wells in Woodbury meet or exceed the HI of 1. Treatment has been provided for individual residences that have received health advisories.

4. Water supply improvement options identification and evaluation

The second step of the Conceptual Plan development process involved the identification and evaluation of water supply improvement options. These water supply improvement options are general project types that could improve drinking water supply quality and quantity in the East Metropolitan Area, without specifying details such as PFAS treatment technology (if applicable), location, source water, scale, or capacity. These options represent the initial list of project types that would be considered further in the development of this Conceptual Plan. As a next step, conceptual projects that were consistent with these water supply improvement options were identified and evaluated (Chapter 5).

This chapter provides an overview of the approach to identify and evaluate water supply improvement options (Section 4.1) and a summary of the evaluation of each option (Section 4.2).

4.1 Approach to identify and evaluate water supply improvement options

The approach to identify and evaluate water supply improvement options is presented below.

4.1.1 Identification of water supply improvement options

Water supply improvement options were identified that could improve drinking water supply quality and quantity in the East Metropolitan Area, including both centralized and decentralized water supply systems. The list of options included all alternatives considered in the Washington County Municipal Water Coalition Water Supply Feasibility Assessment (Metropolitan Council, 2016b), as well as additional options added by the Co-Trustees. The Government and 3M Working Group, the Citizen-Business Group, and Subgroup 1 reviewed the initial list, and provided refinements and suggested additional options to be added (as reflected in the list below). Public input was also requested on the initial list.

The final list of water supply improvement options considered in this Conceptual Plan is as follows (generally going from decentralized to centralized systems):

1. Provide point-of-use treatment (POUT) or point-of-entry treatment (POET) of drinking water.
2. Create new small community water system(s) (with treatment).
3. Move private well hookups to existing municipal water system(s) (where available).
4. Provide drinking water treatment of existing municipal water system(s).
5. Drill new wells in optimized locations.
6. Create new regional water supply system(s) (with treatment).
7. Connect subsets of communities to SPRWS.
8. Create one or more new surface water treatment plants (SWTPs) for use of Mississippi and/or St. Croix River waters.

9. Non-potable and potable reuse of treated 3M containment water
10. Minimize water well use by reducing current potable demand, through:
    - Beneficial use of other non-treated or less-treated water (e.g., grey water, storm water), and
    - Water conservation.

See Section 4.2 (below) for a description of each option.

These options represent the initial list of project types that would be considered in the development of this Conceptual Plan. These options were then evaluated against a set of screening criteria to determine their relevance to the affected communities (described below), and then used to inform the identification of conceptual projects for each community (Chapter 5).

4.1.2 Water supply improvement options screening criteria

Water supply improvement options were evaluated against a set of screening criteria to determine their relevance to the individual communities in the East Metropolitan Area. This step was conducted to determine whether there are any options that are not viable for one or more communities. If a given option was determined to not be viable, it would not be considered further for that specific community in the Conceptual Plan.

For this step in the process, a standard set of screening criteria was used to evaluate the options. These criteria were considered minimum requirements for any option to be considered further. This step of the process was focused on the technical aspects of the option, and did not consider specific preferences of the government units, work groups, or the Co-Trustees. However, further analyses of these options would be conducted later during the development and evaluation of scenarios.

Specific screening criteria used in the evaluation of water supply improvement options are as follows:

1. Be technically and administratively feasible
2. Address drinking water supply and/or groundwater protection/restoration issues due to PFAS contamination in the East Metropolitan Area consistent with Priority 1 of the Settlement
3. Comply with applicable/relevant federal, state, tribal, and local laws, regulations, and rules (in some limited instances, projects that conflict with local regulations and rules can be considered if a reasonably achievable plan is provided to address these conflicts)
4. Not jeopardize public health or safety
5. Not negatively impact results of remediation under the 2007 Consent Order or other remedies addressing other sources of contamination

These criteria were developed previously by the Co-Trustees with input from the Government and 3M Working Group, and the Citizen-Business Group, to support the screening of projects considered under Priority 1 of the Settlement.

Water supply improvement options had to meet all the screening criteria to be considered further. None of the options were eliminated at this stage, but some options were determined to have limited technical and/or administrative feasibility (the first criterion above) for some communities. An overview of the evaluation is provided in Section 4.2, below.

4.2 Evaluation of water supply improvement options

This section provides an overview of each water supply improvement option and a summary of the evaluation of each option against the screening criteria, with a particular focus on differences in technical and administrative feasibility (Criterion 1). At this stage, each option is evaluated in isolation, without any assumptions about whether or how different options would be combined. Table 4.1 summarizes the evaluation of the water supply improvement options.

4.2.1 Provide POUT or POET drinking water systems

Description of the option

This option would involve installing and maintaining treatment systems, such as GAC filters, on private wells. While POUT (i.e., faucet-only) systems were identified as a treatment option, they do not provide treatment for an entire household. Neither POUTS nor whole-home systems treat outside water. Untreated water used for irrigation or other purposes would reintroduce PFAS to the environment. Despite this, POETSs were considered for this evaluation because they prevent the need to install and maintain multiple POUT systems. This option would apply to residences on private wells.

Screening criteria evaluation

Criterion 1 – Technical and administrative feasibility

This option would be feasible for residences on private wells in all communities of the East Metropolitan Area, except the Prairie Island Indian Community, where the property with the irrigation well is currently vacant. This option requires maintaining the treatment system, including a process for monitoring the condition of treatment systems to determine when maintenance should be performed, and, when needed, changing out filter media. These maintenance activities will carry a long-term cost, but do not limit the feasibility of this option.

Criterion 2 – Address drinking water supply issues

This option would contribute to enhancing drinking water supply in the East Metropolitan Area, consistent with Priority 1 of the Settlement. However, it would not address all drinking water supply needs, such as for those residents and businesses served by municipal water systems. Therefore, this option would have to be implemented in conjunction with one or more other options.

Criterion 3 – Comply with applicable laws, regulations, and rules

No compliance issues have been identified with this option.

Criterion 4 – Not jeopardize public health or safety

There are no known impacts on public health or safety with this option.

Criterion 5 – Not negatively impact results of remediation

There are no known impacts on the results of remediation with this option.

4.2.2 Create new small community water system(s) (with treatment)

Description of the option

This option would involve creating one or more new small community water systems to serve neighborhood-sized clusters of residences that are currently on individual private wells.

Screening criteria evaluation

Criterion 1 – Technical and administrative feasibility

This option is most applicable in communities with clusters of residences that use private wells. This option would not apply to Lakeland and St. Paul Park since they do not have clusters of residences on private wells. In addition, this option has low feasibility in Afton due to an ordinance against using private wells for more than one residence. Neighborhoods in Cottage Grove, Lake Elmo, Newport, Oakdale, and Woodbury are not likely to create small community water systems, given the feasibility of connecting to an existing municipal water system in those communities. The same is true for Maplewood, where it would be most feasible to connect residences on private wells to SPRWS.

National drinking water standards dictate that water supplies serving 15 or more homes (or other connections), or 25 people or more for at least 60 days a year, be designated as a public water system. This means they must comply with federal standards, such as providing additional water treatment redundancy in infrastructure, and employing a trained treatment plant operator. Operation of these systems would require new organizational and governance infrastructure (e.g., staff, oversight boards, financing mechanisms). Regulatory compliance and the necessary organizational and governance infrastructure could limit the feasibility of this option, as small communities may not have the resources to run a public water system.

Criterion 2 – Address drinking water supply

This option would contribute to enhancing drinking water supply in the East Metropolitan Area, consistent with Priority 1 of the Settlement. However, it would not address all drinking water supply needs, such as for residents and businesses served by municipal water systems. Therefore, this option would have to be implemented in conjunction with one or more other options.

Criterion 3 – Comply with applicable laws, regulations, and rules

As noted above, a small community water system serving 15 or more connections or 25 or more people is classified as a public water system and must comply with requirements under the Safe Drinking Water Act and other requirements.

Criterion 4 – Not jeopardize public health or safety

There are no known impacts on public health or safety with this option.

Criterion 5 – Not negatively impact results of remediation

There are no known impacts on results of remediation with this option.

4.2.3 Connect private residences to existing municipal water system(s)

Description of the option

This option would involve connecting residences on private wells, including non-community public supply wells (e.g., at parks, schools, recreation centers), to existing municipal water systems. It is assumed that private well users would be connected to a nearby municipal water system where feasible, including Cottage Grove, Lake Elmo, Lakeland, Lakeland Shores, Maplewood, Newport, Oakdale, St. Paul Park, and Woodbury.

Screening criteria evaluation

Criterion 1 – Technical and administrative feasibility
It is more feasible to connect residences on private wells in more densely populated areas where a municipal water system already exists. This includes most areas of the East Metropolitan Area, with the exception of Denmark and most of Afton. Areas of Cottage Grove, Lake Elmo, and Oakdale, for instance, are not as densely populated, but are in closer proximity to existing water mains. For those residences located far from existing water mains and more spread out, substantial new pipe would be required to enable the connection, which would increase the costs and administrative burden of this option.

This option would not apply to the Prairie Island Indian Community, as the property with the non-municipal well is currently vacant.

Criterion 2 – Address drinking water supply issues
This option would contribute to enhancing drinking water supply in the East Metropolitan Area, consistent with Priority 1 of the Settlement. However, it would not address all drinking water supply needs, such as for residents and businesses served by municipal water systems. Therefore, this option would have to be implemented in conjunction with one or more other options.

Criterion 3 – Comply with applicable laws, regulations, and rules
No compliance issues have been identified with this option.

Criterion 4 – Not jeopardize public health or safety
There are no known impacts on public health or safety with this option.

Criterion 5 – Not negatively impact results of remediation
There are no known impacts on the results of remediation with this option.

4.2.4 Provide drinking water treatment to existing municipal water system(s)

Description of the option
This option would provide drinking water treatment to existing municipal water systems that are impacted by PFAS contamination. Treatment would be accomplished using established technologies, such as GAC systems or ion exchange (IX) in the future. IX is not currently approved for use in Minnesota by MDH. Treatment would be provided to manage existing or potential future PFAS contamination.

Screening criteria evaluation

Criterion 1 – Technical and administrative feasibility
This option would be feasible for communities with existing municipal water systems, including Cottage Grove, Lake Elmo, Lakeland/Lakeland Shores, Newport, Oakdale, St. Paul Park, and Woodbury.

This option would not apply to communities that do not have existing municipal water systems, including Afton, Denmark Township, Grey Cloud Island Township, Prairie Island Indian Community, and West Lakeland Township. In addition, this option would not apply to Maplewood since it is primarily supplied by SPRWS.

Criterion 2 – Address drinking water supply issues
This option would contribute to enhancing drinking water supply in the East Metropolitan Area, consistent with Priority 1 of the Settlement. However, it would not address all drinking water supply

needs, such as for residents and businesses on private wells. Therefore, this option would have to be implemented in conjunction with one or more other options.

Criterion 3 – Comply with applicable laws, regulations, and rules
No compliance issues have been identified with this option.

Criterion 4 – Not jeopardize public health or safety
There are no known impacts on public health or safety with this option.

Criterion 5 – Not negatively impact results of remediation
There are no known impacts on results of remediation with this option.

4.2.5 Drill new wells in optimized locations

Description of the option
This option would involve drilling new wells to replace or supplement existing wells. Wells would have to be drilled in optimized locations to avoid aquifers with current PFAS contamination and, to the extent possible given the best available science, avoid using aquifers that might become contaminated in the future. This option could include drilling new wells in areas outside the community that will be served by the well(s), and developing the pipelines and associated infrastructure to move the water to the target community.

Screening criteria evaluation

Criterion 1 – Technical and administrative feasibility
This option is most feasible for communities with existing municipal water systems, specifically Cottage Grove, Lake Elmo, Lakeland/Lakeland Shores, Newport, Oakdale, St. Paul Park, and Woodbury. For these communities, a new municipal supply well could provide safe and reliable water, but would require identifying optimized locations to avoid current contamination and minimize the chance that the well would be affected by contamination in the future. Since all available aquifers in the East Metropolitan Area are known to be affected by varying PFAS compounds to some degree (depending on geographic location), identifying optimized locations for new municipal supply wells may require siting wells outside the communities to be served by the wells. This would require additional infrastructure to move the water to the target communities, adding to the cost.

The feasibility of this option for Lake Elmo, Lakeland, and Oakdale may be lower than for other communities with municipal water systems. Based on PFAS sampling to date, the aquifer that Lakeland's municipal supply wells currently draw from (Mt. Simon) has relatively low levels of PFAS (11 to 12 parts per trillion), compared to occurrences of up to 300 parts per trillion in the Metropolitan Area, regardless of known PFAS source areas nearby. However, there are restrictions on drilling new wells in this aquifer (see Section 3.1.4.2). The upper aquifers near Lakeland are contaminated by TCE and/or PFAS. Lake Elmo and Oakdale currently face restrictions on drilling and groundwater use in northern areas due to their proximity to White Bear Lake. In addition, aquifers in the southern areas of both cities are impacted by PFAS.

The feasibility of this option is low for residences that use private wells, which is the sole drinking water source for residents and businesses of Afton, Denmark, Grey Cloud Island, and West Lakeland. A new well would need to be drilled either at a location or depth to avoid aquifers with PFAS contamination; however, the deepest and least-impacted aquifer (Mt. Simon) has new well drilling restrictions (see Section 3.1.4.2). Available shallower aquifers in the East Metropolitan Area are known to have PFAS

impacts in at least some portion of the aquifer, which make it challenging to identify an optimized location within a private well user's current property boundaries.

Drilling a well outside a private well user's property boundary would require additional infrastructure to bring the water to their property (pipelines and possibly additional pumping capacity). In many cases, an optimized location may be a substantial distance from the target property, which would require a substantial amount of new infrastructure that would cross other properties, and agreements between property owners. If this is the case for many residences that currently use private wells, the total cost could be very high and the evaluation of such circumstances would be significant.

Overall, an evaluation of optimized well locations for residences on private wells would need to be done on a case-by-case basis, and is therefore not feasible within the scope of the Conceptual Plan.

This option would not apply to Maplewood since it is primarily supplied by SPRWS.

Criterion 2 – Address drinking water supply issues

This option would contribute to enhancing drinking water supply in the East Metropolitan Area, consistent with Priority 1 of the Settlement. However, it would not address all drinking water supply needs, such as for those residents and businesses on private wells. Therefore, this option would have to be implemented in conjunction with one or more other options.

Criterion 3 – Comply with applicable laws, regulations, and rules

State regulations and rules about the region's aquifers must be considered for this option. The Mt. Simon aquifer is the deepest aquifer in the area (see the discussion under Criterion 1 above and Section 3.1.4.2). However, Minnesota Statutes § 103G.271, subd. 4a, restricts the DNR from issuing new water-use permits that will appropriate water from this aquifer in a metropolitan county (see Section 3.1.4.2). These restrictions are in place to prevent contaminants from being introduced into the Mt. Simon aquifer. The cross-contamination can occur when shallow PFAS-impacted groundwater enters the deeper aquifer during well drilling, pumping at high rates, or regular well use. The natural buffer created by bedrock layers above the Mt. Simon aquifer is called an aquitard (see Section 3.1.1). Once the aquitards are pierced, contaminated water can travel to the deeper, less-impacted groundwater.

Other sensitive groundwater use areas should be considered, including drinking water supply management areas and SWBCAs. Impacts from groundwater pumping to other natural resources also need to be considered when evaluating this option.

Criterion 4 – Not jeopardize public health or safety

To avoid potential public health or safety impacts, new wells would have to be drilled in optimized locations (see above), and might need ongoing monitoring to ensure early detection in the event that PFAS contamination were to affect these new wells in the future.

Criterion 5 – Not negatively impact results of remediation

As with Criterion 4, the key factor in preventing impacts on remediation is to site new wells in optimized locations, which would prevent new groundwater pumping from causing unanticipated movement of PFAS contaminants to new aquifers or new areas of aquifers. This will be evaluated in detail using the groundwater model and later evaluated using the fate and transport model in applicable areas.

4.2.6 Create new regional water supply system(s) (with treatment)

Description of the option

This option would involve creating a new regional water supply system to be shared by at least two communities. This option could use a surface water and/or groundwater source, and would likely be applied for multiple communities across the East Metropolitan Area. Possible communities that could become regional suppliers, given their current infrastructure and/or administrative capacity, include Cottage Grove, Lakeland, Maplewood, Newport, Oakdale, Prairie Island Indian Community, St. Paul Park, and Woodbury.

Screening criteria evaluation

Criterion 1 – Technical and administrative feasibility

Developing a new regional public water system would require new infrastructure to interconnect the communities involved with the source(s) of water. No technical issues would prevent this; however, local conditions such as topography, existing roads, and other factors would have to be considered in planning new infrastructure.

Administratively, a new regional public water system would require a new governance structure (e.g., a board or a commission with representation for each community), and integrated management systems for engineering, operations, financing, and other functions. In general, these are feasible for many communities but would require substantial work to develop and implement. Being part of a new regional water system may not be feasible for smaller, less-dense communities, given the cost of necessary infrastructure and the administrative burden of running such a system.

Criterion 2 – Address drinking water supply issues

This option would contribute to enhancing drinking water supply in the East Metropolitan Area, consistent with Priority 1 of the Settlement. However, it would not address all drinking water supply needs if not all residents and businesses in the East Metropolitan Area are able to connect. Therefore, this option might need to be implemented in conjunction with one or more other options.

Criterion 3 – Comply with applicable laws, regulations, and rules

This option is expected to comply with all applicable laws, regulations, and rules, though various permits and compliance processes would likely be required.

Criterion 4 – Not jeopardize public health or safety

In terms of a regional groundwater supply system, there are no known impacts on public health or safety. However, if a community switches from groundwater supply to a surface water source, there may be an impact on taste for users, as well as impacts on pipes and other infrastructure due to a change in water chemistry.

Criterion 5 – Not negatively impact results of remediation

There are no known impacts on the results of remediation with this option.

4.2.7 Connect subset of communities to SPRWS

Description of the option

This option would involve connecting communities to SPRWS, either directly or via secondary connection through an adjoining community. A direct connection to SPRWS could be done for Newport and Oakdale due to their proximity to existing SPRWS infrastructure. A secondary connection through an

adjoining community would be more likely for Cottage Grove, Grey Cloud Island Township, Lake Elmo, St. Paul Park, and Woodbury. This option could be applied to serve all residents and businesses within the East Metropolitan Area, but doing so would require additional distribution infrastructure.

Screening criteria evaluation

Criterion 1 – Technical and administrative feasibility

Currently SPRWS, which draws water from the Mississippi River in Fridley, has 25 million gallons per day (mgd) in additional capacity. The water demand for the whole East Metropolitan Area is approximately 50 mgd. However, SPRWS is willing to complete significant capacity and infrastructure improvements, which would allow this option to be applied across the whole East Metropolitan Area. SPRWS uses groundwater for backup supply and it is possible they would need to expand their backup groundwater system if they took on additional demand from the East Metropolitan Area.

This option would involve more work and costs to connect the communities of Afton, Denmark, Grey Cloud Island, Prairie Island Indian Community, and West Lakeland, since they do not currently have municipal water systems or associated distribution infrastructure. Communities connecting to SPRWS with existing distribution infrastructure have their own set of technical challenges due to the need for infrastructure upgrades, including additional length and capacity (diameter) of water main and anti-corrosion measures, which affect the cost of this option.

Criterion 2 – Address drinking water supply issues

This option would contribute to enhancing drinking water supply in the East Metropolitan Area, consistent with Priority 1 of the Settlement. However, as noted above, SPRWS has about 25 mgd of spare capacity, while the entire East Metropolitan Area requires about 50 mgd for projected water demand through 2040. If SPRWS is able to complete capacity and infrastructure improvements, this option could be applied across the whole East Metropolitan Area.

Criterion 3 – Comply with applicable laws, regulations, and rules

No compliance issues have been identified with this option.

Criterion 4 – Not jeopardize public health or safety

Switching to surface water for communities with existing groundwater-sourced systems would likely alter groundwater movement after pumping is stopped, and this could affect movement of PFAS contaminants. It is unlikely that this would pose new risks. In addition, ongoing monitoring would track whether new areas of aquifers have become impacted by PFAS.

Switching to a surface water source generally has an impact on taste for users, but this is unlikely to have health or safety impacts. The switch could also impact pipes and other infrastructure due to a change in water chemistry.

Criterion 5 – Not negatively impact results of remediation

As stated above, switching to surface water from groundwater could alter groundwater movement after pumping is stopped at existing municipal supply wells, and this could affect movement of PFAS contaminants. There is the possibility this could also affect results of remediation, but ongoing monitoring would track whether new areas of aquifers have become impacted by PFAS.

4.2.8 Create a new SWTP for use of Mississippi or St. Croix waters

Description of the option

This option would involve the construction of one or more SWTPs drawing water from the Mississippi River and/or the St. Croix River. It would also require the construction of new intakes on the Mississippi River and/or St. Croix River, pipelines to deliver the water to the SWTPs, and additional infrastructure to deliver the water to existing or newly constructed distribution systems.

Screening criteria evaluation

Criterion 1 – Technical and administrative feasibility

Supplying water from a centralized SWTP would require a public water system (or multiple connected systems) to operate, maintain, and administer the associated infrastructure (i.e., a distribution system). As a result, this option would be most feasible for communities that already have a public water system. Other communities could form or join a public water system, but administrative and infrastructure costs (e.g., connecting residences that are currently on private wells) would likely be cost-prohibitive for communities with lower population density. This would also be true for residents or businesses in Maplewood that are not part of the public water system and are using private wells.

SWTPs require large investments to build and they carry substantial O&M costs. To achieve cost savings, it would be most efficient to develop no more than two SWTPs for the East Metropolitan Area. This could include building one large SWTP to serve most or all of the 14 affected communities, or two smaller SWTPs, one on the Mississippi River and one on the St. Croix River. Siting one large SWTP for the whole East Metropolitan Area may be more challenging given the large footprint necessary.

Criterion 2 – Address drinking water supply issues

This option would contribute to enhancing drinking water supply in the East Metropolitan Area, consistent with Priority 1 of the Settlement. However, cost and other issues would make this option less feasible for communities that currently do not have a public water system. Therefore, this option may need to be combined with one or more other options.

Criterion 3 – Comply with applicable laws, regulations, and rules

This option would require permits under Minnesota Statutes, the Federal Clean Water Act and Safe Drinking Water Act, and possibly other statutes. These are standard regulatory processes for using surface water, and constructing and operating SWTPs, and this option would need to comply with all these requirements.

Criterion 4 – Not jeopardize public health or safety

Switching to surface water for communities with existing groundwater-sourced systems would likely alter groundwater movement after pumping is stopped, and this could affect movement of PFAS contaminants. It is unlikely that this would pose new risks, and ongoing monitoring would track whether new areas of aquifers have become impacted by PFAS.

Switching to a surface water source generally has an impact on taste for users, but this is unlikely to have health or safety impacts. A larger concern is the potential impact on existing infrastructure, mainly water lines, due to a change in water chemistry. This would need to be addressed through chemical addition, and further evaluation would be necessary during the design phase before implementation, particularly in areas where the distribution water lines are older and there is the potential for lead service lines or piping to be present.

Criterion 5 – Not negatively impact results of remediation

As stated above, switching to surface water from groundwater could alter groundwater movement after pumping is stopped at existing wells, and this could affect movement of PFAS contaminants. There is the possibility this could affect results of remediation, but additional monitoring wells would be necessary to track whether new areas of aquifers have become impacted by PFAS.

4.2.9 Non-potable and potable reuse of treated 3M containment water

Description of the option

This option involves the reuse of treated containment water at the former 3M disposal site. Currently, groundwater treatment at the former 3M disposal site results in millions of gallons of water being pumped from the affected aquifers daily. The treated water could be reused for non-potable or potable purposes, though there are some significant challenges (see below).

Screening criteria evaluation

Criterion 1 – Technical and administrative feasibility

Reuse of treated 3M containment water could be feasible for communities near the treatment sites (Cottage Grove, Lake Elmo, Oakdale, and Woodbury) if they have a demand for reuse water (i.e., industrial applications for water treated to non-potable standards). Much of this water is currently being reused by 3M in its industrial processes. Non-potable reuse of treated 3M containment water would be less feasible for communities that do not have an active 3M groundwater containment system within them or lie adjacent one.

Several drawbacks significantly limit the feasibility of non-potable reuse of 3M containment water:

- There are no non-potable or surface water/wastewater discharge standards for PFAS, and protective precedents have been set to treat non-potable water to non-detect levels. In essence, this requires treating to potable water standards even for uses such as irrigation (considered a discharge), further contributing to treatment costs.
- Non-potable reuse would require a new infrastructure system for distributing the water (often referred to as a “grey water” system). This system would have to be completely separate from drinking water and wastewater infrastructure, and may require a variance from Minnesota plumbing code, increasing costs, especially for reuse sites at a greater distance from pumping sites.

Potable reuse of normal (non-PFAS contaminated) wastewater is challenging because of the level of treatment required, as discussed above; and the associated cost relative to other sources of water, the potential for health impacts, and, in many cases, a lack of public trust in the quality of treated wastewater for use as drinking water. For these reasons, this option is considered to have low feasibility, and was not considered further in the Conceptual Plan.

Criterion 2 – Address drinking water supply issues

Non-potable reuse of 3M containment water for industrial uses, if any can be identified, would meet only a very small portion of the water needs of the region. Therefore, this option would need to be implemented in conjunction with one or more other options.

Criterion 3 – Comply with applicable laws, regulations, and rules

The State regulates wastewater treatment and reuse; therefore, the implementation of this option would have to comply with those requirements.

Criterion 4 – Not jeopardize public health or safety
There are no known impacts on public health or safety associated with non-potable reuse of treated containment water if it is used for industrial purposes. Non-potable reuse for irrigation and potable reuse was considered to have low feasibility and not considered further in the Conceptual Plan.

Criterion 5 – Not negatively impact results of remediation
There are no known impacts on results of remediation with non-potable reuse of treated containment water if it is used for industrial purposes.

4.2.10 Minimize water well usage by reducing current potable demand

Description of the option
A wide range of conservation practices can reduce indoor, outdoor, and industrial water use, including upgrading plumbing fixtures and appliances, detecting and fixing distribution system leaks, installing closed-loop reuse systems for some industrial applications, and using "gray water" for landscape irrigation. Such practices are widely implemented throughout Minnesota and the United States. These practices could help reduce overall water use today, the future need for more water supply, and, as a result, groundwater pumping. All East Metropolitan Area municipal water systems are currently working to reduce water consumption to 75 gallons per capita per day, the conservation goal set by the DNR (2018). However, many communities are not yet close to that goal and may not be able to achieve that goal even in the long term without incentives such as buy-back programs or city-/region-wide mandates.

While this option meets all the screening criteria below, it addresses water demand rather than water supply. Thus, conceptual projects were not developed for this option as part of this Conceptual Plan (see Chapter 5).

Screening criteria evaluation

Criterion 1 – Technical and administrative feasibility
There are no known technical or administrative issues that limit the feasibility of water conservation measures in the East Metropolitan Area.

Criterion 2 – Address drinking water supply issues
Even with reduced demand for water due to new conservation measures, residents and businesses in the East Metropolitan Area will need a reliable water supply of roughly 50 mgd by 2040. Therefore, while this option could reduce the total amount of water needed, it would need to be applied in conjunction with one or more options to address all drinking water supply needs in the East Metropolitan Area, consistent with Priority 1 of the Settlement.

Criterion 3 – Comply with applicable laws, regulations, and rules
No compliance issues have been identified with this option.

Criterion 4 – Not jeopardize public health or safety
There are no known impacts on public health or safety with this option.

Criterion 5 – Not negatively impact results of remediation
There are no known impacts on results of remediation with this option.

4.2.11 Use of treated water from multi-benefit wells

Description of the option

Potable or non-potable use of treated 3M containment water was considered as one of the general water supply improvement options as discussed above. Ongoing legal cases and recent court decisions about groundwater use and nearby White Bear Lake have again raised the possible benefits of using treated groundwater from multi-benefit wells for water supply. Recent court decisions and resulting regulatory decisions could restrict the installation and use of new groundwater wells that affect water levels in White Bear Lake. Simultaneously, future remedial actions may include the installation of pump-and-treat wells in contaminated areas. As a result, the Co-Trustees may again consider options for using treated remediation water as a source of water supply. Due to the potential location of multi-benefit wells in the future, this option would be applicable for Lake Elmo and Oakdale.

The potential for implementing multi-benefit wells was incorporated into the development of the Conceptual Plan later in the process than the options presented above. As a result, multi-benefit wells are not incorporated into the conceptual projects presented in Chapter 5 or the scenarios presented in Chapter 6. However, this option is evaluated here so that the Co-Trustees may consider in the future.

Criterion 1 – Technical and administrative feasibility

If pump and treat wells are implemented, they are most likely to be located around Lake Elmo. Therefore, these would be most feasible as a supply options of the communities of Lake Elmo and Oakdale.

Criterion 2 – Address drinking water supply issues

This option provides for large volumes of groundwater removal and treatment in order to improve the long-term groundwater quality of the drinking water resources in the region of Oakdale, Lake Elmo and West Lakeland. Pump-and-treat wells could provide more than a sufficient amount of water to meet Lake Elmo's and Oakdale's estimated 2040 demand and could provide supplemental treated drinking water to other communities. Treated water in excess of the municipal demands would need to be injected back into the aquifers to maintain safe groundwater elevations. The detailed technical evaluation of this option is underway with pumping tests being conducted in the summer of 2021. The pumping tests will provide data on the aquifer's ability to withstand significant pumping and water re-injection. Further water quality evaluations will be necessary as part of the feasibility study of this option to maintain aquifer integrity and improve the resource permanently.

Criterion 3 – Comply with applicable laws, regulations, and rules

The Multi-Benefit Well option would need to comply with the court's White Bear Lake decision in order to install pumping wells within a 5-mile radius of White Bear Lake. It would also need to comply with DNR water appropriations and injection regulations. However, the technical evaluations underway for this option are aimed at collaboratively addressing these concerns. Through the evaluation of this option, the East Metro model and Project 1007 combined surface water and groundwater model are used in conjunction with data from the targeted pumping tests to inform the technical sub-group experts from the DNR, MPCA, MGS, University of Minnesota, and contractors. Addressing the technical concerns will provide the Co-Trustees with sound, data-driven recommendations for the appropriateness of this option.

Criterion 4 – Not jeopardize public health or safety

Water from pump-and-treat wells would be treated with the same/similar technologies as used for treatment on municipal and private wells. PFAS would be removed to the same standards as achieved with existing technologies. This option will require additional evaluation and monitoring to ensure aquifer water quality through the re-injection phase.

Criterion 5 – Not negatively impact results of remediation

There are no known impacts on results of remediation with this option. This option would be aimed at providing sustainable drinking water sources which are one-in-the-same as the treated drinking water options outlined in other supply options detailed herein, while simultaneously achieving remediation objectives to reduce PFAS impacts permanently, thereby improving the regional drinking water resource. This would help reduce PFAS contamination concentrations in groundwater in the area.

4.2.12 Summary of the evaluation of water supply improvement options

Table 4.1 summarizes the technical and administrative feasibility of each option for each community; based on information from the communities and other sources to determine which options could feasibly work, but it does not reflect community preferences.

Table 4.1. Technical and administrative feasibility of each option.

Water supply improvement option	SPRWS[a]	Private well communities						Public water system and private well communities							
	Maplewood	Afton	Denmark	Grey Cloud Island	Prairie Island Indian Community	West Lakeland	Cottage Grove	Lake Elmo	Lakeland	Lakeland Shores[b]	Newport	Oakdale	St. Paul Park	Woodbury
1. Provide POUT or POETSs for drinking water.	●	●	●	●	○	●	●	●	●	●	●	●	●	●
2. Create new small community water system(s) (with treatment).	○	○	◖	◖	◖	◖	○	○	○	○	○	○	○	○
3. Move private well connections to existing municipal water system(s) (where available).	●	◖	◖	●	✕	●	●	●	●	●	●	●	●	●
4. Provide drinking water treatment for existing municipal water system(s).	✕	✕	✕	✕	✕	✕	●	●	●	●	●	●	●	●
5. Drill new wells in optimized locations.	✕	◖	◖	◖	◖	◖	◖	◖	○	●	●	◖	●	●
6. Create new regional water supply system(s) (with treatment).	✕	◖	◖	◖	●	◖	●	●	●	●	●	●	●	●
7. Connect subsets of communities to SPRWS.	●	◖	◖	◖	◖	◖	●	●	●	●	●	●	●	●

Water supply improvement option	SPRWS[a]	Private well communities						Public water system and private well communities							
	Maplewood	Afton	Denmark	Grey Cloud Island	Prairie Island Indian Community	West Lakeland	Cottage Grove	Lake Elmo	Lakeland	Lakeland Shores[b]	Newport	Oakdale	St. Paul Park	Woodbury
8. Create a new SWTP for use of Mississippi River or St. Croix River waters.	✕	◖	◖	◖	○	◖	●	○	●	●	●	○	●	○
9. Non-potable and potable reuse of treated 3M containment water.	○	○	○	○	○	○	○	○	○	○	○	○	○	○
10. Minimize water well usage by reducing current potable demand.	●	●	●	●	●	●	●	●	●	●	●	●	●	●
11. Use of treated water from multi-benefit wells	✕	✕	✕	✕	✕	✕	✕	◖	✕	✕	✕	◖	✕	✕

LEGEND	● Generally feasible	◖ Possibly feasible, but there are challenges to address	○ Low feasibility	✕ Not applicable

a. Maplewood is connected to SPRWS, with some residences on private wells.

b. Lakeland Shores is connected to Lakeland's municipal water system.

5. Conceptual project identification

The third step of the Conceptual Plan development process involved the identification of potential conceptual projects for each community. These conceptual projects are consistent with the water supply improvement options described in Chapter 4, but provide more detail, such as information on project location(s), project components(s), and PFAS treatment technologies (if applicable). The list of conceptual projects represents the range of potential solutions for improving drinking water supply for the affected communities in the East Metropolitan Area; however, additional projects may be identified and evaluated at a later date as new information comes to light. As a next step, these potential projects were bundled into scenarios and evaluated using the drinking water distribution and groundwater models (as will be discussed in Chapter 6).

This chapter provides an overview of the approach to identify conceptual projects (Section 5.1) and a summary of the conceptual projects identified for further evaluation (Section 5.2).

5.1 Approach for identifying conceptual projects

The approach to identify conceptual projects is presented below.

5.1.1 Preliminary identification of projects

Building from the water supply improvement option evaluation (Chapter 4), an initial list of potential conceptual projects was identified for each of the 14 communities currently known to be affected by PFAS contamination in the East Metropolitan Area. This initial list was developed by the Co-Trustees based on discussions with the government units and supplemented with additional project ideas, such as inter-community options.

5.1.2 Work group input

Members of the Government and 3M Working Group, the Citizen-Business Group, and Subgroup 1 provided input on the list of potential conceptual projects. First, this initial list was shared with Subgroup 1 technical members for review and feedback. Then, a revised list of conceptual projects was shared with the three work groups for additional review and feedback. All work group members could also submit ideas via the online project portal (discussed below in Section 5.1.3).

5.1.3 Public input

A request for project ideas from the public was conducted through an online project portal posted on the Minnesota 3M PFC Settlement website (https://3msettlement.state.mn.us/). The submission window was open from August 6 to September 4, 2019. The project idea request was circulated through GovDelivery, the 3M Settlement listserve, press releases to local newspapers, work group members, and the government units.

A total of 24 project ideas were received during the submission window. This included 14 project ideas from the government units (via the work group members) and 10 project ideas from individuals.

5.1.4 Final list refinement

Based on feedback from the work groups, the conceptual project list was refined to exclude redundant or duplicative projects and incorporate new project submittals that were received. The final list consisted of 103 unique conceptual projects.

5.2 Conceptual project list

Appendix D presents the final list of potential conceptual projects identified for each of the 14 communities. This list includes projects that were identified by the Government and 3M Working Group, the Citizen-Business Group, Subgroup 1, members of the public, and the Co-Trustees. Table 5.1 provides a summary of the types of conceptual projects identified for each community, organized by water supply improvement option. The range of potential conceptual projects varies by community due to differences in community characteristics (e.g., those with municipal water systems vs. those without), location of water supply sources, and other factors (e.g., proximity of residences to each other).

These projects were then bundled into scenarios and evaluated using the drinking water distribution and groundwater models. The scenarios were then further evaluated using a set of evaluation criteria. Based on this evaluation, the Co-Trustees provided recommended options that included sets of conceptual projects that provide safe, sustainable drinking water to the East Metropolitan Area. Chapter 6 provides the results of the modeling and evaluation of the scenarios.

The potential to use multi-benefit wells (i.e., pump-and-treat wells) as a source of safe drinking water was covered in Section 4.2.11. As described earlier, this option was identified late in the Conceptual Plan process and was not thoroughly discussed or reviewed with the work groups or the communities. As a result, this idea is not included in the list of conceptual projects or in the drinking water scenarios presented in chapter 6.

Table 5.1. Summary of conceptual project types identified for each community, organized by water supply improvement option. A checkmark indicates the potential conceptual project was identified for that specific community. These conceptual projects were then bundled into scenarios and evaluated using the drinking water distribution and groundwater models.

Water supply improvement option	SPRWS[a]	Private well communities					Public water system and private well communities							
	Maplewood	Afton	Denmark	Grey Cloud Island	Prairie Island Indian Community	West Lakeland	Cottage Grove	Lake Elmo	Lakeland	Lakeland Shores[b]	Newport	Oakdale	St. Paul Park	Woodbury
1. Provide POUT or POETSs of drinking water.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2. Create new small community water system(s) (with treatment).		✓	✓	✓		✓	✓	✓			✓	✓		✓
3. Move private well hookups to existing municipal water system(s) (where available).	✓						✓	✓	✓	✓	✓	✓	✓	✓
4. Provide drinking water treatment of existing municipal water system(s).							✓	✓	✓	✓	✓	✓	✓	✓
5. Drill new wells in optimized locations.					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6. Create new regional water supply system(s) (with treatment).	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7. Connect subsets of communities to SPRWS.				✓			✓	✓			✓	✓	✓	✓
8. Create a new SWTP for use of Mississippi River or St. Croix River waters.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
9. Non-potable and potable reuse of treated 3M containment water.														
10. Minimize water well usage by reducing current potable demand.								✓[c]						

a. Maplewood is connected to SPRWS, with some residences on private wells.
b. Lakeland Shores is connected to Lakeland's municipal water system.
c. As noted in Section 4.2.10, this water supply improvement option does not directly address water supply, and, thus, no conceptual projects were developed for this option by the Co-Trustees. However, one project was submitted online for Lake Elmo, which is indicated in the table.

6. Scenario development and evaluation

This chapter provides a description of the fourth step of developing the Conceptual Plan: formulating and evaluating scenarios. Steps one through three are described in the previous chapters.

These scenarios consist of sets of conceptual projects that, when combined, address PFAS-related drinking water quality and quantity issues for the 14 communities currently known to be affected by PFAS contamination in the East Metropolitan Area. Once developed, these scenarios were assessed using the drinking water distribution and groundwater models. The scenarios were then further evaluated using a set of pre-determined evaluation criteria. As the next step (step five), the Co-Trustees provided a draft recommendation on the scenarios that provide safe, sustainable drinking water to the East Metropolitan Area (presented in Chapter 7).

This chapter provides an overview of the approach to developing and evaluating the scenarios (Section 6.1), an overview of the original scenarios (Section 6.2), an overview of the revised scenarios (Section 6.3), the results of the modeling and costing (Section 6.4), and a summary of the scenario evaluations (Section 6.5).

6.1 Scenario development and evaluation

The approach to developing and evaluating the scenarios is presented below, including scenario development (Section 6.1.1), scenario modeling and costing (Section 6.1.2), and scenario evaluation (Section 6.1.3).

6.1.1 Scenario development

Using the conceptual projects identified in Chapter 5, four groups of scenarios were developed and evaluated in this Conceptual Plan, including:

1. Community-specific scenario – This scenario consists of conceptual projects submitted by the government units and tribal entities for the affected communities in the East Metropolitan Area.
2. Regional scenarios – These scenarios involve a shared public water system for the whole East Metropolitan Area, and include both groundwater and surface water options.
3. Treatment scenarios – These scenarios involve implementing treatment at existing drinking water wells, both public and private, as well as at irrigation and commercial wells in the East Metropolitan Area.
4. Integrated scenario – This scenario involves a combination of conceptual projects from the community-specific, regional, and treatment scenarios.

Within each scenario group, one or more scenarios were considered, with variations in conceptual projects and/or assumptions. The original scenarios were first developed in 2019 and early 2020, and were released for work group review and public feedback in February 2020. After the development and evaluation of these original scenarios, a review period allowed for the submission of public feedback.

Public and community meetings were held to supplement written feedback. Various communities also submitted revised water use projections and/or provided additional information.

The feedback on the original scenarios, as well as additional information provided by the communities, was considered by the Co-Trustees when they revised the community-specific and treatment scenarios. During this step, some of the original scenarios were not carried forward for further refinement and analysis. Information on both the original and revised scenarios is presented later in this chapter.

Additional information and detailed discussion of the results can be found in Appendix H. In Appendix H, Section H.1 contains the information and results for the scenarios evaluated, Sections H.2 and H.3 contain the information and results for the revised community-specific and treatment scenarios, and Section H.4 contains the draft recommended scenarios. Note that Section H.1 was not updated to address comments received, and Sections H.2 and H.3 are a result of the feedback and comments that were received.

6.1.2 Scenario modeling and costing

Each of the scenarios was assessed using the drinking water distribution and groundwater models (for an overview of these models, see Chapter 2). The drinking water distribution model allows for an analysis of each scenario to determine the potential infrastructure installations and improvements necessary to meet future capacity requirements. The groundwater model assesses potential groundwater supply well locations using a drawdown analysis, and assesses future hydrogeologic impacts of increased or decreased groundwater use, including movement of known PFAS contamination based on particle tracking.

Cost estimates for each scenario were also developed, including capital and O&M costs. For the purposes of this Conceptual Plan, the cost estimates are considered screening level. The Association for the Advancement of Cost Engineering (AACE) International's cost estimate classification for a screening-level estimate is Class 5 (AACE, 2019). This Class 5 designation can be attributed to the complexity of the Conceptual Plan and its execution, as well as the time and level of effort available to prepare the estimates.

The cost estimates were developed over the course of two years and drew from a variety of example projects, the majority of which were five years old or less at the time of their inclusion. Since the costs were developed, the building materials market has entered a period of high variability. While the final plan does account for changes due to inflation, other factors that the cost estimate has not accounted for may affect building costs at the time of implementation.

The cost assumptions are outlined with additional detail in Appendix H. Note that the costs in Appendix H are for informational purposes only in order to show the initial set of results that were presented. Cost assumptions were refined for Appendix E (and are documented in Appendix F), and cannot be compared to the costs in Appendix H.

As the process moved forward with the second round of scenario evaluations, cost estimates were developed for the revised community and treatment scenarios, as described in Appendix H, Section H.2. A primary set of cost estimates was developed that included all costs relative to the improvement projects, which were considered "all-inclusive costs." These costs included all improvements necessary for each alternative, including new water lines, treatment facilities, POETSs, water storage tanks, etc., as seen in the previous evaluation. However, not all of these costs will be covered by Settlement funds (e.g., those costs related to growth that would have been incurred regardless of the PFAS contamination). The following guidelines were used to determine which aspects of the project would be

eligible for Settlement funding. It is important to note that while the guidelines below were used in determining general Settlement funding, case-by-case considerations were also taken into account and will continue to be considered. Items determined ineligible for Settlement funding include:

- Additional treatment beyond the treatment threshold selected
- Line upsizing due to growth
- Installation of wells needed for growth alone (as opposed to replacing a well that fell out of service due to PFAS contamination)
- Treatment required for chemicals other than PFAS (with the exception of pretreatment required for PFAS treatment technologies)
- Storage tanks needed for growth only
- Infrastructure recapitalization costs
- New developments, and water main extensions to those neighborhoods
- Existing neighborhood/home connections and water main extensions that are not due to PFAS or are not deemed to be cost-effective compared to other options such as POETSs
- O&M for anything other than treatment plants and POETSs (e.g., O&M for water storage tanks, distribution or raw water lines, booster pump stations)

Costs that were considered not covered were removed from the all-inclusive costs, and the remaining costs to be paid from the Settlement were referred to as Settlement-eligible costs. These Settlement-eligible costs also exclude any neighborhoods or individual homes that had originally been proposed to be connected to the distribution system in the initial scenario evaluation, but were later determined to either not be connected or to require additional sampling or evaluation before determining whether to connect them.

A third set of cost estimates termed “particle tracking costs” was developed that further reduced the Settlement-eligible costs by removing costs associated with the groundwater model particle tracking results. The particle tracking costs include those costs associated with treating wells or providing a municipal supply connection that is located within the projected areas of future particle movement, which originate in areas currently impacted by PFAS above an HI of 1.0. These costs are included in a contingency category in the cost allocations in the final plan.

As discussed in previous sections and chapters of the Conceptual Plan, particle tracking was used to anticipate potential areas of PFAS contamination over the next 20 years. Since a fate-and-transport analysis has not been performed at this time, it is unknown what the concentration of PFAS contamination could be in the projected areas. As a conservative assumption, costs were included to provide POETS or connection to a municipal supply for all wells that fell within these projected areas. However, these areas may never encounter PFAS contamination to a level requiring treatment. These costs were therefore moved to a future contingency fund to address wells that may need future treatment due to PFAS contamination movement, changing health values, or cost overruns for eligible expenses. This fund was termed “future contingency fund for HBV/HRL and plume movement.”

The modeling and costing results provide information to support the evaluation of the scenarios against the evaluation criteria (described below). The specific cost implications as they relate to each community are further discussed in Appendix H, Section H.2.

6.1.3 Scenario evaluation criteria and evaluation approach

The scenarios were evaluated using a set of criteria (Table 6.1) that support the evaluation of projects considered under Priority 1 of the Settlement. The criteria and the approach for applying them were developed by the Co-Trustees with input from the Government and 3M Working Group, and the Citizen-Business Group. The criteria shown in Table 6.1 were used to evaluate scenarios; however, several criteria were not applicable at the scenario level (see Table 6.1 for the rationale).

Each scenario had to meet the first criterion (see Focus Criterion #1) to be considered further in the evaluation. Scenarios that met the first criterion were then evaluated with the remaining criteria. For each applicable criterion, a qualitative rating of either "+," "O," or "-" was applied using the evaluation matrix as a guide (Table 6.1). These qualitative ratings describe how each scenario performs against the criteria relative to the other scenarios.

The evaluation of the scenarios was completed by the Co-Trustees and supported by technical experts from MPCA, DNR, and MDH, and outside consultants from Abt and Wood. In addition, the Co-Trustees considered input from the Government and 3M Working Group, the Citizen-Business Group, and the general public.

The application of the qualitative ratings (+/O/-) for each criterion relied on quantitative outputs from the models, the estimated costs, expert judgement by technical experts, and input from the work groups and the public. In each case, to qualify for a stronger rating (i.e., a "+" or "O"), the Co-Trustees required that there be clear information to demonstrate that the scenario definitively meets the definition for the rating shown in Table 6.1. The example below illustrates the approach used to determine each rating, and Table 6.2 shows information sources used for each criterion.

Many of the scenarios consist of multiple projects across all of the communities. In some cases, a scenario might warrant different ratings across its separate projects, or different ratings across the communities. To the extent feasible, the summary rating for each criterion (shown in Table 6.5 at the end of this chapter) was set by the lowest level of performance for a project or community within the scenario. In other words, if a scenario has one project that is rated as "-"against a criterion, its overall rating for that criterion is set to "-" for that given scenario. This allows the Co-Trustees, the work groups, and the public to easily see which scenarios have key weaknesses.

A summary of the scenario evaluation is provided in Section 6.4, and the rationale for each rating is provided in Appendix G.

Example 1: Rating Scenario 2A against Criterion 7a

Scenario 2A would involve one large regional water treatment plant on the Mississippi River to serve all 14 communities (details provided in Section 6.2 and in Appendix H). Groundwater wells would be maintained for emergency backup supply.

Criterion 7a requires that scenarios "Address future water needs" with the following definitions for the three ratings:

+ = High likelihood of being able to address future water needs
O = Some likelihood of being able to address future water needs
– = Low likelihood of being able to address future water needs

The treatment plant and associated infrastructure under Scenario 2A would be sized to meet the projected 2040 maximum daily demand of 52 mgd. Water availability in the Mississippi River at the diversion point is sufficient and reliable to meet this demand. Further, groundwater wells would be maintained as a backup supply during emergencies (e.g., temporary disruption of treatment plant operation due to infrastructure outage).

As a result, the Co-Trustees concluded that Scenario 2A has a high likelihood of being able to address future water needs, and gave it a rating of "+" for Criterion 7a.

Table 6.1. Evaluation criteria and evaluation framework; the table shows all of the criteria, including several that are not applicable to the drinking water scenarios.

Criteria	Rating	Priority
Focus criteria		
1. For drinking water supply projects, projects that directly address water supplies where HBVs, HRLs, and/or HIs for PFAS are exceeded will be evaluated more favorably.	Scenario will address all water supplies where HBVs, HRLs, and/or HIs for PFAS are exceeded	Required
2. For groundwater protection/restoration projects, projects that are expected to directly or indirectly address water supplies where HBVs, HRLs, and/or HIs for PFAS are exceeded will be evaluated more favorably.	Not applicable (N/A) – no groundwater protection/restoration projects are anticipated to be considered in the Conceptual Plan.	N/A
Implementation criteria		
3. Has a high probability of success (i.e., project outcomes are likely to be achieved).	+ High probability of success (e.g., using reliable/proven technologies/approaches) O Medium probability of success (e.g., using relatively new technologies/approaches that have been successfully used in other places) – Low probability of success (e.g., using unproven technologies/approaches or case studies that show low effectiveness in long-term implementation)	High
4. Has the potential to adapt to new technologies (if applicable).	N/A at the scenario level. It is anticipated that all options will generally be able to adapt to changing technologies as needed.	N/A

Criteria	Rating	Priority
5. Provides long-term benefits (e.g., sustainability of water supply, longevity of infrastructure; assuming all necessary O&M activities are conducted).	+ High likelihood of being able to be sustained over the next 40 years or longer O Some likelihood of being able to be sustained over the next 40 years – Low likelihood of being able to be sustained over the next 40 years	High
6. Provides multiple benefits (e.g., benefits to the aquifer, benefits to multiple communities).	+ Provides substantial ancillary benefits. O Provides some ancillary benefits. – Provides negligible ancillary benefits.	Low
7a. Addresses future water needs (e.g., population growth).	+ High likelihood of being able to address future water needs O Some likelihood of being able to address future water needs – Low likelihood of being able to address future water needs	Medium
7b. Addresses future unknown/uncertain conditions (e.g., new contaminants, movement of contaminants, changing HBVs, climate change impacts).	+ High likelihood of being able to address future unknown/uncertain conditions O Some likelihood of being able to address future unknown/uncertain conditions – Low likelihood of being able to address future unknown/uncertain conditions	High
8. Has low risk of adverse impacts from remedial actions (e.g., those conducted under the Consent Order or other known remedies).	+ Low likelihood of being undone or harmed by actions under the Consent Order or other known remedies O Some likelihood of being undone or harmed by actions under the Consent Order or other known remedies – High likelihood of being undone or harmed by actions under the Consent Order or other known remedies	Medium
9. Has low risk of unintended adverse health impacts (e.g., change in water corrosiveness, generation of disinfection byproducts).	+ Low likelihood of unintended adverse health impacts O Some likelihood of unintended adverse health impacts – High likelihood of unintended adverse health impacts	Medium
10. Minimizes adverse environmental impacts (e.g., movement of contaminants, additional contamination, physical harm to the environment, generation of waste).	+ Negligible or minimal anticipated adverse environmental impacts O Moderate anticipated adverse environmental impacts – Substantial anticipated adverse environmental impacts	Medium
11. Minimizes adverse social impacts (e.g., construction impacts such as noise and poor air quality, disproportionate impact to disadvantaged communities).	+ Negligible or minimal anticipated adverse social impacts O Moderate anticipated adverse social impacts – Substantial anticipated adverse social impacts	Medium
12. Benefits can be measured for success.	N/A at the scenario level – implemented projects will have monitoring plans as needed.	N/A

Criteria	Rating	Priority
Cost criteria		
13. Is cost-effective (metrics may include $ per household, $ per gallon treated; cost to include capital and O&M).	+ High ratio of expected benefits compared to expected costs O Medium ratio of expected benefits compared to expected costs – Low ratio of expected benefits compared to expected costs	Medium
14. Has low, long-term O&M costs.	+ Low, long-term O&M costs O Moderate, long-term O&M costs – High, long-term O&M costs	Medium
15. Has appropriate cost-sharing (if applicable).	N/A at the scenario level – this information will not be incorporated into the Conceptual Plan.	N/A
Other criteria		
16. Would not otherwise occur.	N/A the scenario level – this information will not be incorporated into the Conceptual Plan.	N/A
17. Leverages funds or builds upon existing efforts.	N/A at the scenario level – this information will not be incorporated into the Conceptual Plan.	N/A
18. Is consistent with regional planning (e.g., Metropolitan Council planning, Washington County planning, regional aquifer planning).	+ Consistent with relevant regional planning O Neither conflicts nor is consistent with relevant regional planning – Known or anticipated to conflict with relevant regional planning	Medium
19. Is consistent with local planning (e.g., city comprehensive plans).	+ Consistent with relevant local planning O Neither conflicts nor is consistent with relevant local planning – Known or anticipated to conflict with relevant local planning	Medium
20. Is generally acceptable to the public (as reflected by public feedback on the preliminary results summary and input by the work groups).	+ Generally acceptable to the public O Generally neutral public approval – Generally not acceptable to the public	High

Table 6.2. Sources of information used to evaluate scenarios against the applicable criteria.

Criteria	Sources of information used for evaluating scenarios
Focus criteria	
1. For drinking water supply projects, projects that directly address water supplies where HBVs, HRLs, and/or HIs for PFAS are exceeded will be evaluated more favorably.	Scenario will address all water supplies where HBVs, HRLs, and/or HIs for PFAS are exceeded
Implementation criteria	
3. Has a high probability of success (i.e., project outcomes are achieved).	Expert input from engineers at Wood about the nature of technology and construction used for each project
5. Provides long-term benefits (e.g., sustainability of water supply, longevity of infrastructure; assuming all necessary O&M activities are conducted).	Results from groundwater modeling to determine the sustainability of aquifers. Expert input from engineers at Wood about the expected lifespan of proposed projects Data on surface water availability for scenarios involving surface water
6. Provides multiple benefits (e.g., benefits to the aquifer, benefits to multiple communities).	Project descriptions, input from engineers at Wood, and groundwater modeling results
7a. Addresses future water needs (e.g., population growth).	The amount of water provided in each scenario compared to projected demands for 2040 (see Appendix A for additional details)
7b. Addresses future unknown/uncertain conditions (e.g., new contaminants, movement of contaminants, changing HBVs, climate change impacts).	Input from engineers at Wood about treatment effectiveness Project descriptions and characteristics, including the number of homes that receive newly treated water
8. Has low risk of adverse impacts from remedial actions (e.g., those conducted under the Consent Order or other known remedies).	Input from engineers and scientists from MPCA and Wood about the proximity of proposed projects to existing remediation projects
9. Has low risk of unintended adverse health impacts (e.g., change in water corrosiveness, generation of disinfection byproducts).	Expert input from engineers from MDH about potential water quality issues and the potential for health risks associated with water quality
10. Minimizes adverse environmental impacts (e.g., movement of contaminants, additional contamination, physical harm to the environment, generation of waste).	Data on the locations and layout of proposed projects (e.g., water mains, storage tanks) were compared to data on locations of landscapes that are highly valuable for the purposes of biodiversity and wildlife habitat
11. Minimizes adverse social impacts (e.g., construction impacts such as noise and poor air quality, disproportionate impact to disadvantaged communities).	Data on the locations and layout of proposed projects (e.g., water mains, storage tanks) were compared to (1) datasets on private property boundaries, to estimate how many homes might be affected by construction; and (2) datasets on demographics, to determine whether vulnerable populations would be disproportionately impacted by construction activities

Criteria	Sources of information used for evaluating scenarios
Cost criteria	
13. Is cost-effective (metrics may include $ per household, $ per gallon treated; cost to include capital and O&M).	Twenty-year cost estimates, including both capital and O&M, as presented in Appendix H
14. Has low long-term O&M costs.	O&M cost estimates, as presented in Appendix H
Other criteria	
18. Is consistent with regional planning (e.g., Metropolitan Council planning, Washington County planning, regional aquifer planning).	Regional plans available from the Metropolitan Council and Washington County
19. Is consistent with local planning (e.g., city comprehensive plans).	Community water supply plans
20. Is generally acceptable to the public (as reflected by public feedback on the preliminary results summary and input by the work groups).	Input from working groups and from the public during public comment processes.

Note: Sources of information used for evaluating scenarios were included only for criteria determined to be applicable for drinking water scenarios (see Table 6.1 for more information).

6.2 Overview of the original scenarios

This section provides an overview of the scenarios, including the community-specific scenario (Section 6.2.1), the regional scenarios (Section 6.2.2), the treatment scenarios (Section 6.2.3), and the Integrated scenario (Section 6.2.4), which were initially evaluated. Results for these original scenarios are discussed in detail in Appendix H, Section H.1. These results for the original scenarios are provided for information purposes only; costs and other results were updated based on the feedback received. The feedback received is discussed in greater detail in Chapter 7. Note that costs for each of the original scenarios cannot be compared directly to the revised scenarios, due to additional items included in the revised costs, such as water softeners, administrative startup for new utilities, and consistency in the neighborhoods proposed for connection. A new analysis was conducted on the revised scenarios, and the results are described in Section 6.3 and in Appendix H (Sections H.2 through H.4).

6.2.1 Community-specific scenario

Community-Specific Scenario 1 would provide safe drinking water on a community-by-community basis across the East Metropolitan Area. This scenario consists of conceptual projects submitted by communities through the conceptual project submittal process or communicated in discussions with Wood. These conceptual projects are consistent with each community's existing long-term water supply plan, current efforts, and/or preferred approach. Under this scenario, each community would remain autonomous. Residents and businesses would be served by their local public water system where feasible, and those that could not be connected would continue to be served by their groundwater wells, with treatment as necessary. This scenario would minimize the establishment of new regional water systems, and work within the existing political boundaries and structure of the East Metropolitan Area. Each community was independently analyzed using the groundwater model to assess the location and yield of any required additional groundwater supply well(s), as well as any potential hydrogeological impacts. All community-specific scenarios were initially evaluated to be supplemented by individual GAC systems for private wells that either have an HI ≥ 0.5 (including domestic, commercial, irrigation, and

non-community public supply wells) or are identified within areas predicted to be impacted based on groundwater model particle tracking.

When selecting among multiple alternatives for a community, generally the most cost-effective alternative was selected as part of this scenario. However, in some cases the alternative selected for the overall scenario was not the most cost-effective alternative and was selected for other reasons, as outlined in Appendix H, Section H.1.

6.2.2 Regional scenarios

These scenarios would provide drinking water to the whole East Metropolitan Area via a shared public water system supplied by either surface water or groundwater. Potential surface water sources evaluated include the Mississippi River, the St. Croix River, and extending SPRWS's distribution system. All of the regional surface water options require treatment to make the water potable, but the treatment required is not specific to PFAS. The option to serve all 14 communities via one large SWTP on the St. Croix River was not considered, due to the extended implementation timeframe that would likely be needed as a result of the required environmental regulations and permitting, and the stakeholders involved.

The following regional scenarios were evaluated:

- Regional Scenario 2A – This scenario consists of one large SWTP on the Mississippi River that would provide water to the affected communities in the East Metropolitan Area, including rural areas and townships. The SWTP would have the capacity to meet the total 2040 maximum daily demand of 52 mgd for the East Metropolitan Area. Sizing the SWTP for the 2040 maximum daily demand ensures that existing groundwater wells can be retained for emergency use only. Maplewood residents would not be served by the new SWTP, but instead be served by extending nearby SPRWS's distribution lines.
- Regional Scenario 2B.1 – This scenario consists of two SWTPs, one on the Mississippi River and one on the St. Croix River. The Mississippi SWTP would serve the western communities that have existing public water systems (i.e., Cottage Grove, Newport, Oakdale, St. Paul Park, and Woodbury), as well as Grey Cloud Island. The St. Croix SWTP would serve Afton, Lake Elmo, Lakeland, Lakeland Shores Prairie Island Indian Community, and West Lakeland. The two SWTPs would have a combined capacity capable of meeting the 2040 maximum daily demand for the East Metropolitan Area. Sizing the SWTPs for maximum daily demands ensures that existing groundwater wells can be retained for emergency use only. Maplewood residents would not be served by the new SWTPs, but instead be served by extending SPRWS's distribution lines.
- Regional Scenario 2B.2 – This scenario also consists of two SWTPs, one on the Mississippi River and one on the St. Croix River, as in Scenario 2B.1. However, under this scenario the community of Woodbury would be served by the St. Croix River SWTP rather than the Mississippi SWTP.
- Regional Scenario 2C – This scenario consists of extending SPRWS throughout the East Metropolitan Area.
- Regional Scenario 2D – This scenario consists of one groundwater well field in an optimized location, likely with treatment (as needed), with distribution throughout the East Metropolitan Area.
- Regional Scenario 2E – This scenario consists of multiple groundwater well fields in optimized locations, with or without treatment (as needed), with distribution throughout the East Metropolitan Area.

For Regional Scenarios 2D and 2E, the locations of groundwater well fields were optimized to avoid known PFAS impacts, and the locations of individual wells were optimized based on well interference, as determined by a drawdown analysis.

Under each scenario, new transmission lines would convey flow from the proposed water treatment plant(s) to existing and proposed water storage facilities within each community, to then be distributed via the existing water distribution system. All regional scenarios would be supplemented by individual GAC systems for private wells that either have an HI > 1.0 (including domestic, commercial, irrigation, and non-community public supply wells) or are identified within areas predicted to be impacted based on groundwater model particle tracking.

The regional scenarios were not further refined in the revised scenarios based on the feedback received during the first public comment period, which indicated that these options were not supported.

6.2.3 Treatment scenarios

These scenarios would provide treatment for existing drinking water wells, both public and private, at individual well sites. Two treatment technologies were evaluated under these scenarios for the public drinking water wells, including GAC and IX. GAC was evaluated only for private wells. An assessment of these and other PFAS treatment technologies is provided in Appendix F, Section F.3.

Relative costs associated with the levels of contamination described below (Scenarios 3A–3D) are provided as a desktop exercise, but do not reflect efficiencies that may be realized upon additional analysis (e.g., via centralized treatment facilities as opposed to treating each well individually). Those efficiencies are explored in the community-specific and integrated scenarios.

The determination of providing treatment to wells impacted above HRLs is based on the MDH HI calculation. The HI is calculated as the sum of five PFAS concentrations (in parts per billion) divided by their respective (most conservative) HBV or HRL, as shown in the equation below. Note that concentrations are expressed in parts per trillion elsewhere in the Conceptual Plan.

$$HI\ (PFAS) = \left(\left(\frac{[PFOA]}{0.035}\right) + \left(\frac{[PFOS]}{0.015}\right) + \left(\frac{[PFBA]}{7}\right) + \left(\frac{[PFBS]}{2}\right) + \left(\frac{[PFHxS]}{0.047}\right)\right)$$

The calculated HI does not include all PFAS, but rather only those that have HRLs or HBVs, as defined by the MDH (i.e., PFOS, PFOA, PFHxS, PFBA, and PFBS).

The following treatment scenarios were evaluated:

- Treatment Scenario 3A – This scenario would provide treatment at each well (both public and private drinking water wells) with PFAS detections of HI (PFAS) > 1.
- Treatment Scenario 3B – This scenario would provide treatment at each well (both public and private drinking water wells) with PFAS detections of HI (PFAS) ≥ 0.5.
- Treatment Scenario 3C – This scenario would provide treatment at each well (both public and private drinking water wells) with any detection of PFOS, PFOA, and/or PFHxS. PFBA has been detected in groundwater and other media not only across the Twin Cities Metropolitan Area but also worldwide. Requiring treatment of drinking water based on a PFBA and/or PFBS detection alone (i.e., no other PFAS are detected), which is potentially the case in Treatment Scenario 3D, has cost implications, as well as implications for communities outside the East Metropolitan Area. Furthermore, PFBA and PFBS do not tend to build up in human bodies as easily as PFOS, PFOA, and PFHxS, which makes them a lower threat to human health.

- Treatment Scenario 3D – This scenario would provide treatment at each well (both public and private drinking water wells) with PFAS detections of HI (PFAS) > 0.

6.2.4 Integrated scenario

This scenario consists of a combination of conceptual projects included in the community-specific, regional, and treatment scenarios that were bundled to address PFAS-related drinking water quality and quantity issues for the 14 affected communities in the East Metropolitan Area. Ideas for the integrated scenarios were based on projects submitted during the previous step of the process that did not fit under the other categories. These ideas included interconnections between communities and new groundwater well fields, with centralized treatment, that serve multiple communities.

The integrated scenarios were not further refined in the revised scenarios, based on the feedback received during the first public comment period. However, some of the projects from this scenario were carried forward to the revised community-specific scenarios based on factors such as cost-effectiveness and community support.

6.3 Overview of the revised scenarios

This section provides an overview of the revised scenarios, which were developed following the feedback received on the original scenarios. These consist of revisions to the community-specific scenarios (Section 6.3.1) and the treatment scenarios (Section 6.3.2), which were evaluated to develop the final recommendation provided in Chapter 8. Results for these revised scenarios are discussed in detail in Appendix H, Sections H.2–H.4.

The primary changes that were incorporated based on the first public comment period, as well as additional information provided by some communities, include:

- Revised water supply projections from Lake Elmo, Oakdale, and Woodbury
- Refined the groundwater model
- Revised treatment technology O&M costs
- Adjusted land acquisition cost assumptions to include setbacks and green space requirements
- Revised municipal well HI values to better reflect MDH methodologies
- Incorporated Baytown TCE data – POETSs installed and sampling data
- Revised private well counts in Afton and West Lakeland
- Evaluated neighborhood hookups for each community, as applicable

6.3.1 Revised community-specific scenario

After the initial stages of evaluation, feedback and additional information submitted by the communities required modifications to some of the community alternatives, while the selected alternatives for the remaining communities remained the same. Cost assumptions were also adjusted based on feedback received.

The community-specific scenario was modified to create the revised Community-Specific Scenarios A, B, C, and D, as described below.

- Community-Specific Scenario A – community alternatives selected from the original scenarios
- Community-Specific Scenario B – same as Scenario A except Oakdale is supplied by SPRWS

- Community-Specific Scenario C – same as Scenario A except Oakdale and Lake Elmo are supplied by SPRWS
- Community-Specific Scenario D – same as Scenario A except West Lakeland Township is supplied by Prairie Island Indian Community

For each community-specific scenario, results were provided for scenarios that factored in treatment thresholds of HI > 0 and HI ≥ 1. This provided a range of costs associated with the number of wells that would require treatment under a treatment threshold of HI > 0 and HI ≥ 1.

From the above analysis, incremental costs were determined for scenarios for every HI threshold between 0 and 1 in increments of 0.1. These results, presented at the end of Appendix H, Section H.2, helped to inform the recommended scenarios.

6.3.2 Revised treatment scenario

As with the community scenario, feedback received after the initial round of evaluations led to a set of revised community and treatment scenarios. The revised treatment scenarios, evaluated under the same criteria described in Section 6.2.3, are described in Appendix H, Section H.3.

6.4 Scenario results summary

Appendix H contains the modeling and costing details for the original sets of scenarios completed as part of the Conceptual Plan process described above. While the following tables summarize the cost estimates for each scenario, more-detailed costs and supporting information and assumptions can be found in Appendix H. The first table (Table 6.3) below provides the costs for the original scenarios, while the second table (Table 6.4) provides the costs for the revised community-specific and treatment scenarios, which can be found in Sections H.1-H.3 of Appendix H.

Table 6.3. Modeling and cost results for each of the original scenarios; September 2020.

Scenarios	Communities affected[a]	Components	Water provided	Capital cost (000s)[b]	% of $700 million Settlement funds	Annual O&M cost (000s)[b]	Total 20-year costs					
							Undiscounted				Including 3% inflation	
							Total 20-year cost (000s)[b]	% of $700 million Settlement funds	O&M cost per thousand gallons	Capital and O&M cost per thousand gallons	Total 20-year costs (000s)[b]	% of Settlement funds
Community-Specific Scenario 1 (IX)	All except for Denmark and Newport	Municipal (44 wells) and non-municipal (969 wells) water addressed with groundwater treatment plants (GWTP) via community-proposed projects	55 mgd	$405,820	58%	$11,874	$643,300	92%	$0.59	$1.60	$724,879	104%
Community-Specific Scenario 1 (GAC)	All except for Denmark and Newport	Municipal (44 wells) and non-municipal (969 wells) water addressed with GWTPs via community-proposed projects	55 mgd	$430,329	61%	$18,823	$806,789	115%	$0.94	$2.01	$936,110	134%
Regional Scenario 2A – One SWTP	All except for Denmark	1 SWTP on Mississippi River, plus treatment at 2,070 non-municipal wells	52 mgd	$391,306	56%	$18,001	$751,326	107%	$0.95	$1.98	$875,000	125%
Regional Scenario 2B.1 – Two SWTPs	All except for Denmark	1 SWTP on Mississippi River and 1 SWTP on St. Croix River, plus treatment at 2,070 non-municipal wells	52 mgd total (43 mgd Mississippi SWTP, 8 mgd St. Croix SWTP)	$415,021	59%	$19,668	$808,381	115%	$1.04	$2.13	$943,508	135%
Regional Scenario 2B.2 – Two SWTPs	All except for Denmark	1 SWTP on Mississippi River and 1 SWTP on St. Croix River, plus treatment at 2,070 non-municipal wells	52 mgd total (24 mgd Mississippi SWTP, 28 mgd St. Croix SWTP)	$422,837	60%	$20,264	$828,117	118%	$1.07	$2.18	$967,338	138%
Regional Scenario 2C – SPRWS	All except for Denmark	Transmission of SPRWS to communities, plus treatment at 2,070 non-municipal wells	20–52 mgd (range between average and maximum daily demands)	$347,425	50%	$31,081 (based on average day demand of 20 mgd)	$969,045	138%	$1.64	$2.55	$1,182,583	169%
Regional Scenario 2D – One GWTP	Not a feasible solution, due to lack of water supply for a single 52-mgd well field in Denmark											
Regional Scenario 2E – Two GWTPs (GAC)	All except for Denmark	3 well fields, 2 GWTPs for region-wide groundwater supply, plus treatment at 738 non-municipal wells	52 mgd	$293,417	42%	$15,002	$593,457	85%	$0.79	$1.56	$696,526	100%
Regional Scenario 2E – Two GWTPs (IX)	All except for Denmark	3 well fields, 2 GWTPs for region-wide groundwater supply, plus treatment at 738 non-municipal wells	52 mgd	$280,832	40%	$9,986	$480,552	69%	$0.53	$1.27	$549,160	78%

Scenarios	Communities affected[a]	Components	Water provided	Capital cost (000s)[b]	% of $700 million Settlement funds	Annual O&M cost (000s)[b]	Total 20-year costs					
							Undiscounted				Including 3% inflation	
							Total 20-year cost (000s)[b]	% of $700 million Settlement funds	O&M cost per thousand gallons	Capital and O&M cost per thousand gallons	Total 20-year costs (000s)[b]	% of Settlement funds
Treatment 2040 Scenario 3A.2 – HI > 1.0 (IX)	All except Maplewood and Newport	GWTPs at 28 municipal and 1,623 non-municipal wells	36 mgd	$93,205	13%	$5,824	$209,685	30%	$0.44	$0.80	$249,698	36%
Treatment 2040 Scenario 3A.2 – HI > 1.0 (GAC)	All except Maplewood and Newport	GWTPs at 28 municipal and 1,623 non-municipal wells	36 mgd	$127,356	18%	$11,523	$357,816	51%	$0.88	$1.36	$436,983	62%
Treatment 2040 Scenario 3B.2 – HI ≥ 0.5 (IX)	All except Newport	GWTPs at 39 municipal and 1,647 non-municipal wells	63 mgd	$150,241	21%	$8,252	$315,281	45%	$0.36	$0.69	$371,975	53%
Treatment 2040 Scenario 3B.2 – HI ≥ 0.5 (GAC)	All except Newport	GWTPs at 39 municipal and 1,647 non-municipal wells	63 mgd	$206,861	30%	$18,151	$569,881	81%	$0.79	$1.24	$694,585	99%
Treatment 2040 Scenario 3C.2 – PFOS, PFOA, and PFHxS > 0 (IX)	All	GWTPs at 40 municipal and 1,712 non-municipal wells	64 mgd	$154,074	22%	$8,465	$323,374	46%	$0.36	$0.69	$381,532	55%
Treatment 2040 Scenario 3C.2 – PFOS, PFOA, and PFHxS > 0 (GAC)	All	GWTPs at 40 municipal and 1,712 non-municipal wells	64 mgd	$212,109	30%	$18,597	$584,049	83%	$0.80	$1.25	$711,817	102%
Treatment 2040 Scenario 3D.2 – HI > 0 (IX)	All	GWTPs at 54 municipal and 2,272 non-municipal wells	89 mgd	$214,646	31%	$11,477	$444,186	63%	$0.35	$0.68	$523,037	75%
Treatment 2040 Scenario 3D.2 – HI > 0 (GAC)	All	GWTPs at 54 municipal and 2,272 non-municipal wells	89 mgd	$295,717	42%	$25,790	$811,517	116%	$0.79	$1.25	$988,704	141%
Integrated Scenario 4A (IX)	All	Municipal (44 wells) and non-municipal (809 wells) water addressed with GWTPs while incorporating efficiencies	52 mgd	$403,810	58%	$11,093	$625,670	89%	$0.58	$1.65	$701,883	100%
Integrated Scenario 4B (GAC)	All	Municipal (44 wells) and non-municipal (809 wells) water addressed with GWTPs while incorporating efficiencies	52 mgd	$424,599	61%	$16,373	$752,059	107%	$0.86	$1.98	$864,548	124%

a. Communities affected are those communities that would incur changes to their current water supply under each scenario. Residences and other non-municipal well owners will still receive individual treatment systems under each scenario, as deemed necessary by the MDH based on well testing.
b. Values are given in thousands of dollars. To calculate the actual amount, multiply the number by 1,000.

Table 6.4. Modeling and cost results for the revised scenarios.

Scenarios	Communities affected[a]	Components	Water provided	Capital cost (000s)[b]	% of $700 million Settlement funds	Annual O&M cost (000s)[b]	O&M cost per thousand gallons	Capital and O&M cost per thousand gallons	Total 20-year costs (000s)[b] with 3% inflation	% of Settlement funds
Revised Community-Specific Scenario A – HI > 1.0 (IX)	All	Municipal (34 wells) and non-municipal (3,792 wells) water addressed via community-proposed projects	41 mgd	$377,244	54%	$5,965	$0.40	$2.18	$652,602	93%
Revised Community-Specific Scenario A – HI > 1.0 (GAC)			41 mgd	$399,584	57%	$6,967	$0.47	$2.37	$709,942	101%
Revised Community-Specific Scenario A – HI > 0 (IX)		Municipal (54 wells) and non-municipal (6,293 wells) water addressed via community-proposed projects	70 mgd	$479,561	69%	$9,895	$0.39	$1.73	$886,341	127%
Revised Community-Specific Scenario A – HI > 0 (GAC)			70 mgd	$517,131	74%	$11,679	$0.46	$1.93	$984,281	141%
Revised Community-Specific Scenario A (PFAS eligible) – HI > 1.0 (IX)	All	Municipal (34 wells) and non-municipal (3,792 wells) water addressed via community-proposed projects	41 mgd	$296,534	42%	$4,131	$0.28	$1.36	$407,572	58%
Revised Community-Specific Scenario A (PFAS eligible) – HI > 1.0 (GAC)			41 mgd	$318,754	46%	$5,126	$0.34	$1.53	$456,532	65%
Revised Community-Specific Scenario A (PFAS eligible) – HI > 0 (IX)		Municipal (54 wells) and non-municipal (6,293 wells) water addressed via community-proposed projects	68 mgd	$379,448	54%	$8,229	$0.33	$1.21	$600,641	86%
Revised Community-Specific Scenario A (PFAS eligible) – HI > 0 (GAC)			68 mgd	$413,348	59%	$9,625	$0.39	$1.35	$672,071	96%
Revised Community-Specific Scenario A (PFAS and PT eligible) – HI > 1.0 (IX)	All	Municipal (32 wells) and non-municipal (3,792 wells) water addressed via community-proposed projects	41 mgd	$265,840	38%	$2,927	$0.20	$1.18	$344,525	49%
Revised Community-Specific Scenario A (PFAS and PT eligible) – HI > 1.0 (GAC)			41 mgd	$285,460	41%	$3,815	$0.26	$1.33	$388,015	55%
Revised Community-Specific Scenario A (PFAS and PT eligible) – HI > 0 (IX)		Municipal (54 wells) and non-municipal (6,293 wells) water addressed via community-proposed projects	68 mgd	$351,630	50%	$8,306	$0.33	$1.16	$574,955	82%
Revised Community-Specific Scenario A (PFAS and PT eligible) – HI > 0 (GAC)			68 mgd	$385,410	655%	$9,716	$0.39	$1.30	$646,555	92%
Revised Community-Specific Scenario B – HI > 1.0 (IX)	All	SPRWS supplying Oakdale; treatment at 31 municipal and 3,823 non-municipal wells addressed through projects	41 mgd	$396.663	57%	$8.671	$0.63	$2.70	$749,023	107%
Revised Community-Specific Scenario B – HI > 1.0 (GAC)			41 mgd	$416.963	60%	$9,460	$0.68	$2.88	$797,793	114%
Revised Community-Specific Scenario B– HI > 0 (IX)		SPRWS supplying Oakdale; treatment at 48 municipal and 6,253 non-municipal wells addressed through projects	69 mgd	$480,420	69%	$12,437	$0.50	$1.92	$953,755	136%
Revised Community-Specific Scenario B – HI > 0 (GAC)			69 mgd	$510,250	73%	$13,583	$0.55	$2.06	$1,024,235	146%

Scenarios	Communities affected[a]	Components	Water provided	Capital cost (000s)[b]	% of $700 million Settlement funds	Annual O&M cost (000s)[b]	O&M cost per thousand gallons	Capital and O&M cost per thousand gallons	Total 20-year costs (000s)[b] with 3% inflation	% of Settlement funds
Revised Community-Specific Scenario C– HI > 1.0 (IX)	All	SPRWS supplying Oakdale and Lake Elmo; treatment at 30 municipal and 3,768 non-municipal wells addressed through projects	41 mgd	$365,048	52%	$10,068	$0.67	$2.49	$743,924	106%
Revised Community-Specific Scenario C – HI > 1.0 (GAC)			41 mgd	$383,708	55%	$10,791	$0.72	$2.64	$788,734	113%
Revised Community-Specific Scenario C – HI > 0 (IX)		SPRWS supplying Oakdale and Lake Elmo; treatment at 53 municipal and 6,249 non-municipal wells addressed through projects	70 mgd	$433,787	62%	$13,659	$0.53	$1.81	$924,084	132%
Revised Community-Specific Scenario C– HI > 0 (GAC)			70 mgd	$460,097	66%	$14,660	$0.57	$1.93	$985,894	141%
Revised Community-Specific Scenario C (PFAS eligible) – HI > 1.0 (IX	All	SPRWS supplying Oakdale and Lake Elmo; treatment at 30 municipal and 3,768 non-municipal wells addressed through projects	41 mgd	$321,918	46%	$8,302	$0.47	$1.56	$545,044	78%
Revised Community-Specific Scenario C (PFAS eligible) – HI > 1.0 (GAC)			41 mgd	$340,618	49%	$9,033	$0.52	$1.66	$583,374	83%
Revised Community-Specific Scenario C (PFAS eligible) – HI > 0 (IX)		SPRWS supplying Oakdale and Lake Elmo; treatment at 53 municipal and 6,249 non-municipal wells addressed through projects	69 mgd	$361,677	52%	$12,231	$0.49	$1.37	$690,455	99%
Revised Community-Specific Scenario C (PFAS eligible) – HI > 0 (GAC)			69 mgd	$387,977	55%	$13,240	$0.53	$1.48	$743,895	106%
Revised Community-Specific Scenario C (PFAS and PT eligible) – HI > 1.0 (IX)	All	SPRWS supplying Oakdale and Lake Elmo; treatment at 28 municipal and 3,768 non-municipal wells addressed through projects	48 mgd	$281,019	40%	$7,447	$0.43	$1.37	$481,155	69%
Revised Community-Specific Scenario C (PFAS and PT eligible) – HI > 1.0 (GAC)			48 mgd	$298,659	43%	$8,146	$0.46	$1.48	$517,595	74%
Revised Community-Specific Scenario C (PFAS and PT eligible) – HI > 0 (IX)		SPRWS supplying Oakdale and Lake Elmo; treatment at 53 municipal and 6,249 non-municipal wells addressed through projects	69 mgd	$334,088	48%	$12,335	$0.49	$1.32	$665,577	95%
Revised Community-Specific Scenario C (PFAS and PT eligible) – HI > 0 (GAC)			69 mgd	$360,258	51%	$13,334	$0.53	$1.43	$718,627	103%

Scenarios	Communities affected[a]	Components	Water provided	Capital cost (000s)[b]	% of $700 million Settlement funds	Annual O&M cost (000s)[b]	O&M cost per thousand gallons	Capital and O&M cost per thousand gallons	Total 20-year costs (000s)[b] with 3% inflation	% of Settlement funds
Revised Community-Specific Scenario D – HI > 1.0 (IX)	All	Prairie Island Indian Community serving West Lakeland Township; treatment at 33 municipal and 3,792 non-municipal wells addressed through projects	41 mgd	$303,760	43%	$4,966	$0.33	$1.83	$547,090	78%
Revised Community-Specific Scenario D – HI > 1.0 (GAC)			41 mgd	$327,425	47%	$6,342	$0.42	$2.07	$619,050	88%
Revised Community-Specific Scenario D – HI > 0 (IX)		Prairie Island Indian Community serving West Lakeland Township; treatment at 3 municipal and 6,293 non-municipal wells addressed through projects	70 mgd	$402,420	57%	$7,621	$0.30	$1.47	$752,300	107%
Revised Community-Specific Scenario D – HI > 0 (GAC)			70 mgd	$445,682	64%	$11,030	$0.43	$1.77	$902,080	129%
Revised Treatment Scenario – HI > 1.0 (IX)	All except Maplewood, Newport, and Prairie Island Indian Community	Treatment at 24 municipal and 2,650 non-municipal wells	38	$87,557	13%	$7,018	$0.52	$0.84	$227,917	33%
Revised Treatment Scenario – HI > 1.0 (GAC)	All except Maplewood, Newport, and Prairie Island Indian Community	Treatment at 24 municipal and 2,650 non-municipal wells	38	$119,161	17%	$8,609	$1.07	$0.52	$291,341	42%
Revised Treatment Scenario – HI ≥ 0.5 (IX)	All except Newport and Prairie Island Indian Community	Treatment at 27 municipal and 2,673 non-municipal wells	42	$98,507	14%	$7,434	$0.49	$0.81	$247,181	35%
Revised Treatment Scenario – HI ≥ 0.5 (GAC)	All except Newport and Prairie Island Indian Community	Treatment at 27 municipal and 2,673 non-municipal wells	42	$134,369	19%	$9,186	$1.04	$0.49	$318,072	45%
Revised Treatment Scenario – PFOS, PFOA, and PFHxS > 0 (IX)	All except Prairie Island Indian Community	Treatment at 32 municipal and 4,827 non-municipal wells	53	$127,742	18%	$10,369	$0.54	$0.88	$335,106	48%
Revised Treatment Scenario – PFOS, PFOA, and PFHxS > 0 (GAC)	All except Prairie Island Indian Community	Treatment at 32 municipal and 4,827 non-municipal wells	53	$172,176	25%	$12,436	$1.10	$0.54	$420,877	60%

Scenarios	Communities affected[a]	Components	Water provided	Capital cost (000s)[b]	% of $700 million Settlement funds	Annual O&M cost (000s)[b]	O&M cost per thousand gallons	Capital and O&M cost per thousand gallons	Total 20-year costs (000s)[b] with 3% inflation	% of Settlement funds
Revised Treatment Scenario – HI > 0	All except Prairie Island Indian Community	Treatment at 49 municipal and 5,685 non-municipal wells	84	$198,934	28%	$13,643	$0.45	$0.77	$471,787	67%
Revised Treatment Scenario – HI > 0	All except Prairie Island Indian Community	Treatment at 49 municipal and 5,685 non-municipal wells	84	$270,148	39%	$16,681	$0.99	$0.45	$603,763	86%

a. Communities affected are those communities that would incur changes to their current water supply under each scenario. Residences and other non-municipal well owners will still receive individual treatment systems under each scenario, as deemed necessary by the MDH based on well testing.
b. Values are given in thousands of dollars. To calculate the actual amount, multiply the number by 1,000.

6.5 Scenario evaluation summary

Tables 6.5 and 6.6 summarize how each scenario is rated against the applicable evaluation criteria. Table 6.5 covers the original scenarios (i.e., the costs and features shown in Table 6.3), while Table 6.6 shows the revised scenarios (i.e., the costs and features shown in Table 6.4). They are evaluated separately because the revised scenarios are based on updated assumptions and inputs, including updated water demand forecasts for some communities. Note that Tables 6.5 and 6.6 show ratings for only the applicable criteria; as noted above, the Co-Trustees and work groups agreed that several criteria were not applicable to the drinking water scenarios.

Table 6.5. Ratings against the criteria for each of the original scenarios (the scenarios summarized in Table 6.3).

Criteria (high priority in bold)	Community-specific		Regional						Treatment								Integrated	
	1A (IX)	1A (GAC)	2A, 1 SWTP	2B.1, 2 SWTPs	2B.2, 2 SWTPs	2C, SPRWS	2E, GWTPs (GAC)	2E, GWTPs (IX)	3A, HI > = 1 (IX)	3A, HI > = 1 (GAC)	3B, HI > = 0.5 (IX)	3B, HI > = 0.5 (GAC)	3C, HI* > 0 (IX)	3C, HI* > 0 (GAC)	3D, HI > 0 (IX)	3D, HI > 0 (GAC)	4A (IX)	4B (GAC)
3	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
6	–	–	+	+	+	+	O	O	–	–	–	–	–	–	–	–	–	–
7a	+	+	+	+	+	+	+	+	O	O	+	+	+	+	+	+	+	+
7b	O	O	+	+	+	+	O	O	–	–	O	O	+	+	+	+	O	O
8	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
9	+	+	–	–	–	–	O	O	+	+	+	+	+	+	+	+	+	+
10	–	–	+	+	+	–	–	–	O	O	O	O	O	O	O	O	–	–
11	+	+	+	O	O	–	–	–	+	+	+	+	+	+	+	+	+	+
13	O	–	–	–	–	–	O	O	+	O	+	+	+	+	+	–	O	–
14	+	O	O	O	O	–	O	+	+	+	+	O	+	O	+	–	+	O
18	+	+	O	O	O	O	O	O	O	O	O	O	O	O	O	O	+	+
19	+	+	–	–	–	–	O	O	O	O	O	O	O	O	O	O	O	O
20	+	+	–	–	–	–	–	–	O	O	O	O	O	O	O	O	O	O

* Denotes HI calculate for only three PFAS compounds: PFOA, PFOS and PFHxS.

Table 6.6. Ratings against the criteria for the revised scenarios.

Criteria (high priority in bold)	Community-Specific Scenario A, varying by HI threshold and treatment technology						Community-Specific Scenario B with SPRWS serving Oakdale				Community-Specific Scenario C with SPRWS serving Oakdale and Lake Elmo				
	HI > 1 (GAC)	HI > 1 (IX)	HI ≥ 0.5 (GAC)	HI ≥ 0.3 (GAC)	HI > 0 (GAC)	HI > 0 (IX)	HI > 1 (GAC)	HI > 1 (IX)	HI > 0 (GAC)	HI > 0 (IX)	HI > 1 (GAC)	HI > 1 (IX)	HI ≥ 0.5 (GAC)	HI > 0 (GAC)	HI > 0 (IX)
Recommended[a]			[a]	[a]									[a]		
3	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
7a	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
7b	O	O	O	+	+	+	O	O	+	+	O	O	+	+	+
8	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
9	+	+	+	+	+	+	O	O	O	O	O	O	O	O	O
10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
11	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
13	+	+	+	O	–	–	O	O	–	–	O	+	O	–	–
14	+	+	+	+	–	O	O	O	–	–	O	+	O	–	–
18	+	+	+	+	+	+	O	O	O	O	O	O	O	O	O
19	+	+	+	+	+	+	O	O	O	O	O	O	O	O	O
20	O	O	+	+	+	+	O	O	O	O	O	O	O	O	O

a. These three scenarios are carried forward as part of the draft recommended options in Chapter 7.

7. Recommended options in the Draft Conceptual Plan

7.1 Introduction to the recommended options

The Co-Trustees' goal was to develop a plan that provides safe, sustainable drinking water to the 14 affected East Metro communities, now and into the future, for both public water systems and private wells. To meet their goals, the Co-Trustees followed a strategic planning process that considered the region as a whole, from the source of the drinking water to the faucet, and developed three recommended options.

The recommended options focus mainly on groundwater solutions, based on community preferences for groundwater sources over surface water. The recommended options focus on **groundwater solutions** designed to **invest in treatment systems, drinking water protection, and sustainability**. The Co-Trustees focused on building **resilient systems** and **reserving funding for O&M expenses to reduce cost burdens** and assist with long-term planning. This balance provides resiliency and flexibility by accommodating potential future changes in drinking water health guidance and areas of contamination while also ensuring groundwater supply and minimal impact on affected communities.

In September 2020, the Co-Trustees released the Draft Conceptual Plan that included the following recommended options for public review and comment. As described in Section 7.3 of this chapter, the Co-Trustees preferred Option 1.

Option 1 (preferred)		• GAC treatment for wells that meet the treatment threshold of HI ≥ 0.5 • Funding of public water system O&M for approximately 40 years • Funding of private well O&M for over 100 years • Funding for protecting a sustainable water supply into the future • Drinking water source remains groundwater
Option 2		• GAC treatment for wells that meet the treatment threshold of HI ≥ 0.3 • Funding of public water system O&M for approximately 35 years • Funding of private well O&M for over 100 years • Funding for protecting a sustainable water supply into the future • Drinking water source remains groundwater

Option 3		• GAC treatment for wells that meet the treatment threshold of HI ≥ 0.5 • Funding of public water system O&M for approximately 21 years • Funding of private well O&M for over 100 years • Funding for protecting a sustainable water supply into the future • Oakdale and Lake Elmo are supplied by SPRWS to ensure future water supply • Drinking water source remains groundwater for other communities

Since the release of the Draft Conceptual Plan, the Co-Trustees:

- Held a series of meetings with community stakeholders and the public
- Hosted a public comment period from September 10 to December 10, 2020
- Updated the Draft Conceptual Plan based on feedback from the public and government units

This chapter retains information from the Draft Conceptual Plan and describes the Co-Trustees' approach to developing the recommended options (Section 7.2). It also presents a summary of the three recommended options (Section 7.3), as they were formulated and released in September 2020. The chapter then describes the feedback gathered in response to the Draft Conceptual Plan, and the Co-Trustees' process for updating the recommended options (Section 7.4).

7.2 Approach to developing the recommended options

The fifth step of developing the Draft Conceptual Plan was to review the evaluation of the revised scenarios in Chapter 6, gather and consider feedback, modify the scenarios as necessary, and develop recommended options for public review and the eventual Final Plan. See Section 2.1 for an overview of the Conceptual Plan's stepwise approach, including Step 5 to identify draft recommended options.

In developing the recommended options, the Co-Trustees considered: the long-term program goals for Priority 1 (see text box to the right); the evaluation criteria (see Chapter 6); the analysis of groundwater and drinking water models (see Chapter 2 and Appendix C); feedback from the work groups and Subgroup 1; one-on-one meetings with local leadership and technical staff from the affected communities in the East Metropolitan Area; six public informational and listening sessions; and input received from the public.

Long-term program goals for Priority 1 – Drinking water quality, quantity, and sustainability

- Provide clean drinking water to residents and businesses to meet current and future needs under changing conditions, population, and health values.
- Protect and improve groundwater quality.
- Protect and maintain groundwater quantity.
- Minimize long-term cost burdens for communities related to PFAS.

As described in Chapter 6, all of the revised scenarios were developed to provide safe, sustainable drinking water to all of the affected communities in the East Metropolitan Area, but they differ in technology, the types of projects included, the HI threshold for treatment, and cost. To select which drinking water supply scenarios to include in the recommended options, the Co-Trustees considered similar factors that were used to develop the options, specifically:

- How well the scenarios addressed the long-term program goals (see Section 1.2.1)
- How well the scenarios met the evaluation criteria (see Chapter 6 and Appendix G)

- How well the scenarios addressed feedback provided by the work groups, Subgroup 1, elected officials, and technical staff from the affected communities in the East Metropolitan Area, and members of the public

The recommended options presented in this chapter were centered on three different drinking water supply scenarios, but also included broader recommendations to ensure that the plan addresses long-term program goals for Priority 1. By doing this, the Co-Trustees aimed to provide a roadmap for future decision-making and funding.

7.3 Summary of recommended options

This section presents information about the three recommended options. Section 7.3.1 describes the elements that are common to each of the three options; Section 7.3.2 provides overall information about the elements of the recommended options, including side-by-side tables to facilitate a comparison of the options; and Section 7.3.3 describes the Co-Trustees' preferred option when the options were released in September 2020. The characteristics and cost estimates for the recommended options presented in this section are from the Draft Conceptual Plan, which was released in September 2020. Some of the detailed information originally presented in this section has been moved to Appendix H, Section H.4. Appendix H, Section H.4 also provides additional detail about the recommended options in the Draft Conceptual Plan. The options and costs were updated after the public comment period, as described in Section 7.4. The final recommendation is presented in Chapter 8.

7.3.1 Common elements of all options

While developing the recommended options, the Co-Trustees determined that all options would have the following common components:

- **A treatment threshold that is less than an HI of 1.** As discussed earlier in this Conceptual Plan, the HI threshold for treatment determines which wells receive treatment or are replaced by a connection to a public water system (see the text box to the right).
- **Contingency funds set aside to address additional wells should they become impacted in the future.** The HI threshold for treatment would be used to determine which wells receive treatment or become replaced by a connection to a public water system.
- **GAC as a treatment technology.** Although IX is a well-established technology used throughout the country, MDH has not currently approved it for use in Minnesota. GAC tends to be more expensive than IX, so recommending scenarios that use GAC is a conservative approach that ensures there will be sufficient funding for either technology in the future.

What do the HI thresholds mean? An HI of 1 or greater indicates that one or more PFAS chemicals are present in sufficient concentrations to potentially have a health effect. An HI of 1 or greater triggers a health advisory from MDH.

The Co-Trustees' recommendations use an HI threshold below 1. The understanding of PFAS and the ability to detect it is continually evolving. As a result, HBVs or HRLs may change or new compounds may be added, or the contamination location may change in the future. Instead of being reactive when changes occur, the recommended options are proactive and build a degree of resiliency into communities' drinking water systems to be able to better cover future potential changes. There is substantial interest among the work groups, local governments, and the general public in using an HI threshold less than 1.

Wells with an HI of 1 or greater will be covered by the 2007 Consent Order. As a result, O&M costs for treatment of wells with an HI of less than 1 may eventually have to be covered by ratepayers or homeowners. For more explanation on the PFAS HI, refer to Section 3.1.3.

- **Funding for projects that will deliver finished drinking water at the faucet.** This funding would cover capital costs (including initial capital and potential additional neighborhood connections), O&M costs for treatment facilities, and costs for unforeseen circumstances. The amounts for each option differ across these categories. As described in Section 6.1.2, costs that do not directly address PFAS contamination would not be covered.
- **Funding for projects that ensure the communities' drinking water sources are protected and sustainable.** This included funding for drinking water protection and sustainability and conservation. The drinking water protection fund will be used for PFAS groundwater contamination reduction, which can help reduce future treatment needs and costs, and will generally improve overall water quality. The sustainability and conservation fund would be used to support water conservation measures (among other activities) to help reduce water use and enhance long-term aquifer sustainability.
- **O&M costs for private well treatment.** To ensure effective treatment systems are maintained on private wells, it is necessary to plan for coverage of long-term O&M costs. While communities have the capability to plan for coverage of longer-term costs, the maintenance of private systems is more expensive per household and may be more difficult to achieve without dedicated funds.
- **O&M costs for new treatment infrastructure for public water systems.** The estimated duration in the recommended options varied depending on how much was allocated to initial capital costs. Options with lower projected capital costs and/or lower annual O&M costs could provide funding for O&M for longer periods of time.
- **Connections of some neighborhoods to municipal systems.** The initial capital amount for each option included funding for connecting neighborhoods where a significant number of private wells with elevated HI levels equal to or greater than 1 exist, while considering the long-term cost of connections compared to POETSs.[2] Details on these assumptions are provided in Appendix H. Each option also included funding set aside for additional proposed neighborhood connections that would require additional sampling or evaluation before a decision could be made about connecting them.
- **Feasible approaches for drinking water supply for future growth in light of restrictions related to White Bear Lake.** Modeling based on projections of future water use indicates some East Metro communities may need alternative sources of water to avoid adverse effects on White Bear Lake. Because future DNR regulatory requirements are still being defined, the Co-Trustees recommended two possible approaches for providing additional water supply to Oakdale and Lake Elmo. One approach was to provide funding for using groundwater in ways that comply with the current Court Order for the cities' future growth. Recommended Options 1 and 2 were based on a cost estimate for creating an interconnect from southern Woodbury to Lake Elmo to provide water for their future growth. These options provided Lake Elmo and the state flexibility to explore other approaches within the cost estimate. The other approach was to have SPRWS provide all the water supply for Lake Elmo and Oakdale, as described in Chapter 6 as community-specific Scenario C. This approach was used in recommended Option 3.

2. Some wells with HI values less than the given threshold may still be connected to public water systems because of their proximity to those wells with HI values exceeding the threshold.

7.3.2 Overview of recommended options

This section presents an overview of the three recommended options as presented in the Draft Conceptual Plan. For each of the recommended options, the Co-Trustees allocated $700 million, which is the amount of Settlement funding available after payment of legal fees and deducting the $20 million set aside for Priority 2. This allocation does not include funding for sampling PFAS in wells, which will continue to be managed by the MPCA and MDH and funded by 3M under the Consent Order. The funding categories presented in Tables 7.1-7.3, as well as in Chapter 8, are discussed below.

- **Initial capital costs** are settlement-eligible costs (see Section 6.1.3) to construct the drinking water supply infrastructure based on projected 2040 demand for the given option, including different combinations of treatment, distribution systems, home connections, and POETSs. These costs include water mains and home connections that will be completed as part of the initial implementation. The Co-Trustees recommended that neighborhoods be connected to public water systems if they currently have a significant number of wells with elevated HI values, and if the costs of water mains and connections are less than the cost of POETSs after a reasonable amount of time. Many neighborhoods lacked sufficient sampling data to make the decision about connections at this time; these neighborhoods are discussed below.
- **O&M costs for public water systems and private wells** are estimated costs for the operation and maintenance of treatment facilities (e.g., media change-out, structure maintenance), or costs for purchasing water at bulk rates (applicable for Option 3). The recommended options include separate line items for funding for long-term O&M for treatment systems on public water systems and private wells. The Co-Trustees prioritized O&M costs for treatment, since these costs are more directly tied to the PFAS contamination. Additionally, funding for POETS O&M costs will be provided for as long as feasible so that these costs do not pose undue burdens on individual homeowners. Depending on actual future inflation and interest on funds, the number of years funded could be different from the estimates in the three recommended options presented in September 2020 (see Table 7.1). The allocation for O&M costs covers only treatment facilities (e.g., media change-out, structure maintenance) and does not cover distribution system O&M, which will be covered by the communities. For Option 3, the O&M allocation covers costs for purchasing water from SPRWS at their bulk water rate. It has been assumed that O&M costs would increase 3% annually due to inflation, and that funds would be set aside in an interest-bearing account that would generate an effective rate of return of 3.5%.
- **Capital costs for potential additional neighborhood connections** include costs for additional water mains and home connections that could be completed in the future; these decisions will be based on future information, including additional well testing data. The Co-Trustees allocated Settlement funds to connect those neighborhoods in the future if and when new sampling data show it is reasonable. Treating wells below an HI of 1 could result in future expenses, once the Settlement dollars are depleted, due to O&M expenses not covered for treatment of wells below an HI of 1.
- **Future contingency for HBV/HRL and plume movement, and cost overruns** is funding set aside to address expenses that are difficult to predict today, including future plume movement, future changes in HBV/HRLs, and cost overruns. The amount is partially based on the cost for treatment and/or connections for homes with wells that are within the flow path of the PFAS plumes developed using the groundwater model described in Appendix C. While the model is useful at predicting where known PFAS particles may migrate, the actual plume movement may differ from these predictions, and some areas may never encounter PFAS contamination to a level requiring treatment. One option to address this uncertainty would be to provide treatment

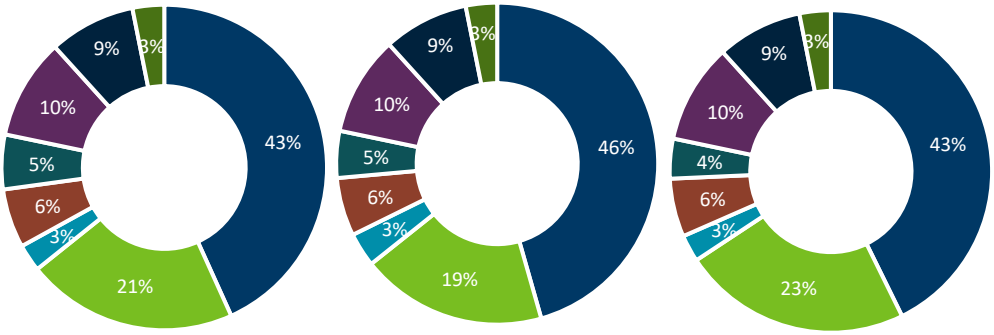
for homes/wells with concentrations lower than an HI of 0.5 in the initial capital, which is why the contingency for projected future impacts is accordingly lower for Option 2. In addition, this category of funding is meant to cover additional treatment and/or municipal connection costs that may arise if HBV/HRLs are reduced in the future.[3]

- **Drinking water protection** is funding set aside to improve drinking water quality at the source. While remediation of the disposal sites is the responsibility of 3M under the 2018 Settlement and 2007 Consent Order, drinking water protection is a component of Priority 1 of the Settlement, and is emphasized in the long-term goals for Priority 1 set out by the Co-Trustees and work groups at the beginning of this process.
- **Sustainability and conservation** is funding set aside to protect groundwater sustainability to preserve groundwater as a drinking water source into the future, and to support sustainable infrastructure enhancements for projects funded by the Settlement. Sustainability is a component of Priority 1 of the Settlement and was a high priority in the public feedback received.
- **State administration** is the anticipated cost to administer the Settlement in full, and to conduct source assessment and feasibility study work for Project 1007 as defined in the Settlement. This estimate is based on current spending for the 3M Settlement program.

3. For any given well, the HI threshold would be used to determine whether that well will receive treatment or be replaced with a connection to a municipal system. The Co-Trustees recommended a threshold lower than 1 to provide some resilience against future changes in contamination or future changes in HBVs or HRLs. Thus, the initial capital investments have been determined using the HI threshold for each recommended option. In the future, if the HI for a given well exceeds the HI threshold because measured PFAS contamination increased, the well would receive treatment or a connection to a municipal system. At the time of the draft Conceptual Plan, the Co-Trustees had not yet determined how to handle cases where the HI for a given well exceeded the treatment threshold due to changes in HBVs or HRLs, but the contamination did not cause an exceedance of the new HI of 1.

Table 7.1. Comparison of cost elements of the recommended options.[a]

Funding priorities	Option 1 (preferred) HI≥0.5 GAC COMMUNITY PROJECTS	Option 2 HI≥0.3 GAC COMMUNITY PROJECTS	Option 3 SPRWS HI≥0.5 GAC COMMUNITY PROJECTS
Total	**$700 million**	**$700 million**	**$700 million**
Initial capital costs	$303 million	$319 million	$299 million
O&M costs for public water systems	$147 million for public water systems for approximately *40 years*	$131 million for public water systems for approximately *35 years*	$161 million for public water systems for approximately *21 years*
O&M costs for private wells	$19 million for private wells covering over *100 years*	$24 million for private wells covering over *100 years*	$19 million for private wells covering over *100 years*
Capital costs for potential additional neighborhood connections	$41 million	$41 million	$41 million
Future contingency for HBV/HRL and plume movement, and cost overruns	$38 million	$33 million	$28 million
Drinking water protection	$70 million	$70 million	$70 million
Sustainability and conservation	$60 million	$60 million	$60 million
State administration	$22 million	$22 million	$22 million



a. The cost estimates for the recommended options presented above are from the Draft Conceptual Plan released in September 2020. The recommended options were updated after the public comment period, as described in Section 7.4, and the Final Plan is presented in Chapter 8.

Table 7.2. Comparison of initial capital investments of the recommended options.[a]

Category		Option 1 (preferred) 	Option 2 	Option 3 
Source water		All groundwater	All groundwater	Groundwater and SPRWS
Homes receiving treatment	**Number of POETSs as a permanent solution**	98	159	98
	Cumulative number of POETSs; includes existing and proposed	236	297	236
	New connections to municipal public water systems	2,062	2,062	2,062
Wells	**Total existing and proposed public wells receiving treatment**	33	39	24
	New public wells built	5 new wells (3 of these replace contaminated wells)	5 new wells (3 of these replace contaminated wells)	3 new wells (1 of these replaces a contaminated well)
	Wells sealed; includes public and private wells	2,070	2,070	2,070
Water treatment plants	**New water treatment plants (total capacity)**	6 (total capacity is 23,580 gpm)	6 (total capacity is 29,580 gpm)	6 (total capacity is 23,580 gpm)
	Modifications to existing water treatment plants (additional capacity)	1 (additional capacity is 1,750 gpm)	1 (additional capacity is 1,750 gpm)	–
Miles of water mains; includes raw water distribution, treated water distribution, and neighborhood mains		72	75.3	74.6

a. The characteristics for the recommended options presented above are from the Draft Conceptual Plan released in September 2020. The recommended options were updated after the public comment period, as described in Section 7.4, and the final recommendation is presented in Chapter 8.

Table 7.3. Comparison of community-by-community initial capital investments for the recommended options.[a]

Community	Option 1 (preferred) 	Option 2 	Option 3 
Afton **Grey Cloud Island** **Denmark** **Maplewood**	• Supply private wells with POETSs if over threshold		
Cottage Grove	• Treat 8 of 12 existing public wells • Replace 2 existing public wells with 1 new public well • Add 2 new water treatment plants • Connect 67 homes • Supply other private wells with POETSs if over threshold		
Lake Elmo	• Supply drinking water from groundwater for future growth[b] • Connect 257 homes • Supply other private wells with POETSs if over threshold		• Connect to SPRWS • Connect 257 homes • Supply other private wells with POETSs if over threshold
Lakeland **Lakeland Shores**	• Connect 453 homes • Supply other private wells with POETSs if over threshold		
Newport	• Interconnect with Woodbury • Connect 9 homes • Supply other private wells with POETSs if over threshold		
Oakdale	• Expand public water system to treat 2 of 9 existing public wells and add 2 new public wells • Connect 58 homes • Supply other private wells with POETSs if over threshold		• Connect to SPRWS • Connect 58 homes • Supply other private wells with POETSs if over threshold
Prairie Island Indian Community	• Treat 1 existing public well • Add 1 new water treatment plant		
St. Paul Park	• Treat 3 of 3 public wells • Add 1 new water treatment plant • Connect 28 homes • Supply other private wells with POETSs if over threshold		
West Lakeland	• Add 2 new public wells • Add 1 new water treatment plant • Connect 1,190 homes to new distribution system		

Community	Option 1 (preferred) 	Option 2 	Option 3 
Woodbury	• Interconnect with Newport • Treat 14 of 19 existing public wells • Add 1 new water treatment plant • Supply other private wells with POETSs if over threshold	• Interconnect with Newport • Treat 15 of 19 existing public wells and 5 new public wells • Add 1 new water treatment plant • Supply other private wells with POETSs if over threshold	• Interconnect with Newport. • Treat 14 of 19 existing public wells • Add 1 new water treatment plant • Supply other private wells with POETSs if over threshold

a. The characteristics for the recommended options presented above are from the Draft Conceptual Plan released in September 2020. The recommended options were updated after the public comment period, as described in Section 7.4, and the final recommendation is presented in Chapter 8.

b. Lake Elmo may need alternative sources of water to avoid adverse effects on White Bear Lake. Initial capital funds provide funding for using groundwater in ways that comply with the current Court Order. This funding level is based on a cost estimate for creating an interconnect from southern Woodbury; however, other approaches within that funding range may also be explored.

7.3.3 Preferred option

In the Draft Conceptual Plan, the Co-Trustees preferred **recommended Option 1 – Community projects with a treatment threshold of HI ≥ 0.5 and GAC**. At that time, the Co-Trustees determined that any of the three options would be reasonable and necessary in response to PFAS releases in the East Metropolitan Area. However, the Co-Trustees believed that recommended Option 1 was preferable because it provides resiliency to potentially lower HRL/HBV PFAS values or changing levels of contamination in the future, while providing for more years of O&M and a larger contingency to address future uncertainty that can be directed where it is needed. Further, once Settlement funds are depleted, the 2007 Consent Order will fund O&M costs for treatment to HI ≥ 1. All of the options address this concern for private residential wells with POETSs by providing O&M funding for more than 100 years; however, recommended Option 1 reduces this additional cost burden for public water supply to continue treatment below HI ≥ 1 relative to recommended Option 2.

7.4 Revising the recommended options

After the release of the Draft Conceptual Plan in September 2020, the Co-Trustees asked the public and government units for feedback and comments on the three recommended options. Based on feedback, the Co-Trustees updated the recommended options; finalized the evaluations of the options; and finalized the plan. This section describes the feedback received during the public comment period (Section 7.4.1) and the cost adjustments for the recommended options (Section 7.4.2).

7.4.1 Public comment period for the Draft Conceptual Plan

After the release of the Draft Conceptual Plan in September 2020, the Co-Trustees held a series of meetings with communities and the public to explain the recommended options, answer questions, and continue discussions about community needs. The Co-Trustees presented to work group members, held

four virtual public meetings, and conducted one-on-one technical and leadership meetings with government units. The Co-Trustees also provided a 90-day public comment period in which East Metro communities submitted public comment letters and members of the public responded to a survey. Below is a summary of these outreach efforts.

- **Work group members** were invited to attend a presentation on the Draft Conceptual Plan. The Citizen-Business Group presentation was held on September 15, 2020, and the Government and 3M Working Group and Subgroup 1 presentations were held on September 16, 2020.
- **Approximately 120 members of the public attended the four virtual public meetings on** September 22 and 23, with most of the East Metro communities represented. A recording of one of the public meetings is posted on the 3M Settlement website at https://3msettlement.state.mn.us/.
- **One-on-one technical and leadership meetings with government units** provided an opportunity to discuss remaining concerns with the characteristics and cost estimates for the recommended options and to understand concerns with the options. From September 2020 through May 2021, the Co-Trustees held approximately 35 meetings with government leaders as well as 3M; from January 2020 through May 2021, the Co-Trustees' technical teams held over 40 meetings with government counterparts.
- **A public comment period** was held from September 10 through December 10, 2020. During it the Co-Trustees received approximately 30 comment letters from 12 entities – including government units and nonprofit organizations, work group members, and 3M – and over 220 survey responses from the public.

Public and work group feedback provided after the public comment period had ended was also considered in finalizing the plan.

Comments from government units and nonprofit organizations, work group members, and the public focused on several key themes:

- **Administrative,** including a request to allow communities to begin preliminary work before the Conceptual Plan is final
- **Capital and O&M,** including concerns about how funds are distributed among communities, suggestions to extend O&M for municipal water systems, and concerns that cost estimates are low and may require communities to cover the difference
- **Funding priority,** with a desire to prioritize and fund drinking water treatment systems before funding other drinking water protection or conservation and sustainability projects
- **Recommended options,** with some communities and members of the public expressing a preference for Option 1 to ensure sufficient funding for everyone or for other needs, while other communities and members of the public expressed a preference to treat more wells through Option 2, and in some cases a preference to treat all wells
- **Divergent preferences of West Lakeland residents,** with many residents expressing a preference to maintain private wells, while other residents indicated an interest in being connected to a new municipal system

Once the public comment period had closed, the Co-Trustees reviewed feedback from the public, and from the work groups and communities, to update the recommended options and finalize the plan.

7.4.2 Cost adjustments for the recommended options

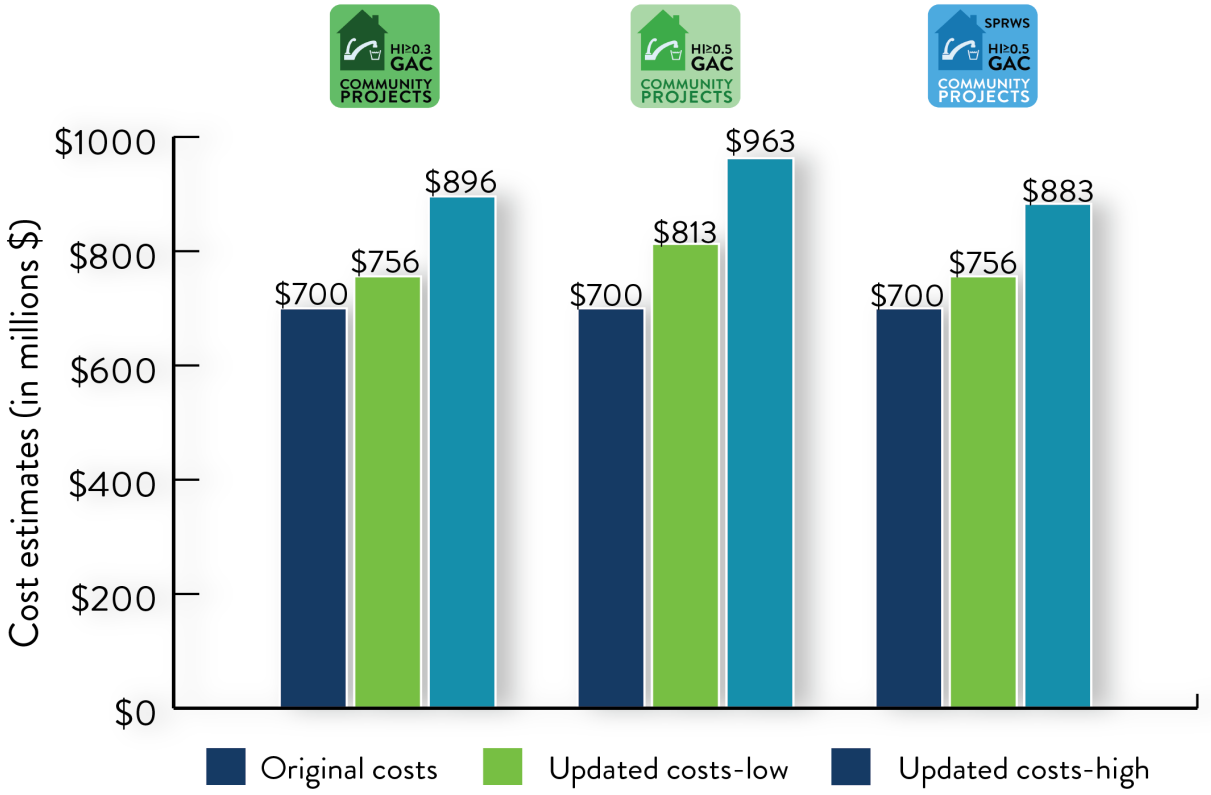
The Co-Trustees incorporated feedback from the public comment period in the revised engineering design and cost estimates for the recommended options. They added costs for stormwater compliance; refined the service lateral costs of connecting homes to municipal systems; included power factor adjustments for large water treatment plants in Cottage Grove and Woodbury; reduced some O&M costs related to SPRWS bulk water rate; and made other minor revisions. Given potential future White Bear Lake restrictions, the Co-Trustees developed multiple options for Lake Elmo and Oakdale's drinking water source.

Assuming O&M durations and other cost allocations remain unchanged from the options presented above, the recommended options with the revised engineering design and cost estimates would exceed available funds in the Settlement (Figure 7.1). In evaluating costs, the Co-Trustees considered two alternatives for West Lakeland: connecting West Lakeland homes to a new municipal system, as described in the Draft Conceptual Plan, or providing West Lakeland homes with POETSs, which is a lower cost alternative. These two alternatives largely drive the differences in the low- and high-cost estimates for the recommended options (Figure 7.1).

- For Option 1, the costs increased from $700 to $756 or $896 million, with a $56 to $196 million shortfall compared to funds available from the Settlement.
- For Option 2, the costs increased from $700 to $813 or $963 million, with a $113 to $263 million shortfall compared to funds available from the Settlement.
- For Option 3, the costs increased from $700 to $756 or $883 million, with a $56 to $183 million shortfall compared to funds available from the Settlement.

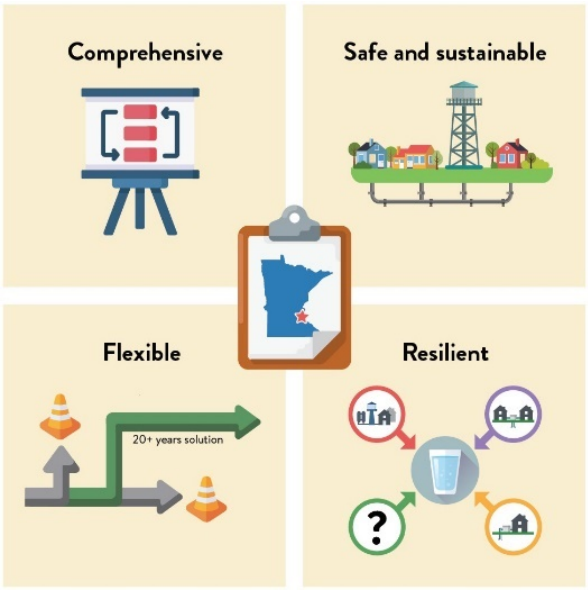
Given that the revised costs exceed Settlement funding by $56 to $263 million, the Co-Trustees considered additional alternatives to provide safe, sustainable drinking water to the affected East Metro communities to develop the Final Plan. The Final Plan is described in Chapter 8.

Figure 7.1. Comparison of the original and the revised cost estimates of the recommended options.



8. Final plan overview and fund allocations

8.1 Introduction



The Co-Trustees (MPCA and DNR) finalized the Conceptual Drinking Water Supply Plan (Final Plan) after considering feedback on the draft plan and revising cost estimates for the recommended options (Appendix E). The Final Plan will provide safe and sustainable drinking water to the 14 affected East Metropolitan Area communities now and into the future.

The Final Plan:

- Includes **drinking water projects recommended by the affected communities**
- Uses **groundwater as the drinking water source**, to the extent possible
- **Prioritizes drinking water protection, drinking water treatment,** and **operation and maintenance (O&M)** for both public water systems and private wells
- Has the **flexibility and resiliency to respond to future uncertainties**

This chapter provides an overview of the elements of the Final Plan and fund allocation (Section 8.2), and discusses the reasoning and how it addresses the goals for Priority 1 of the Settlement (Section 8.3). A more detailed explanation of the funding elements in the Final Plan is provided in Chapter 9.

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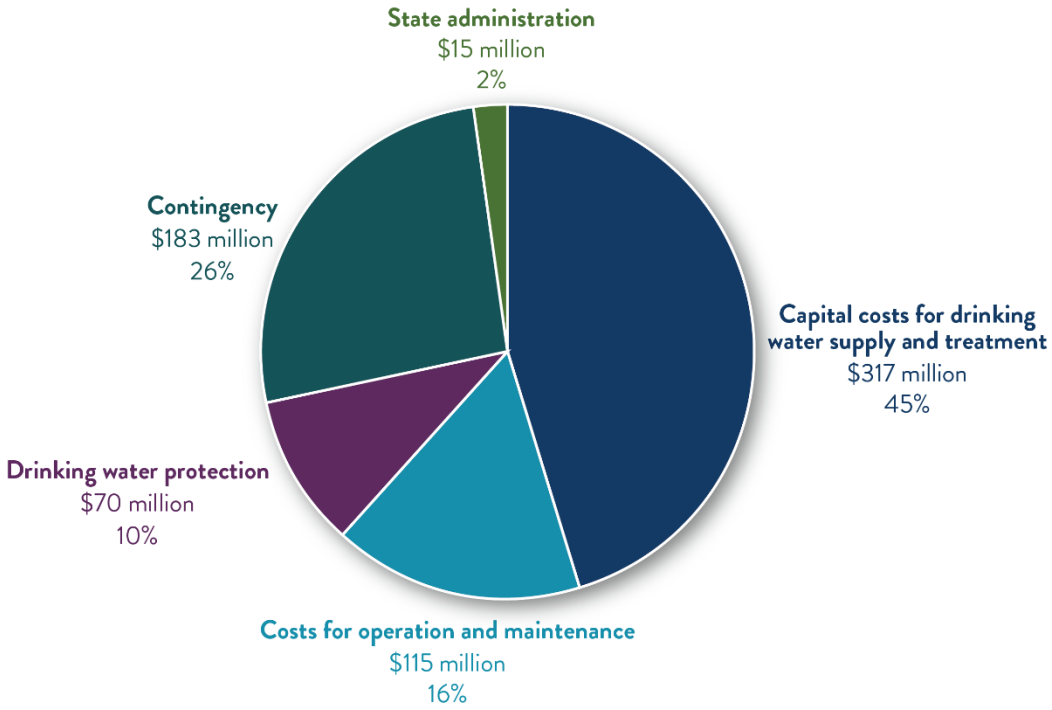
8.2 Elements of the Final Plan and fund allocations

The Co-Trustees allocated the majority of the $700 million in available funding (Figure 8.1)[4] to three main funding priorities:

- **Capital funding (45%)** will be used to construct and install the drinking water supply infrastructure for public water systems and private wells.
- **Operation and maintenance (O&M) funding (16%)** will be used for the public water systems and private well treatment.
- **Drinking water protection funding (10%)** will be used to improve drinking water quality at the source.

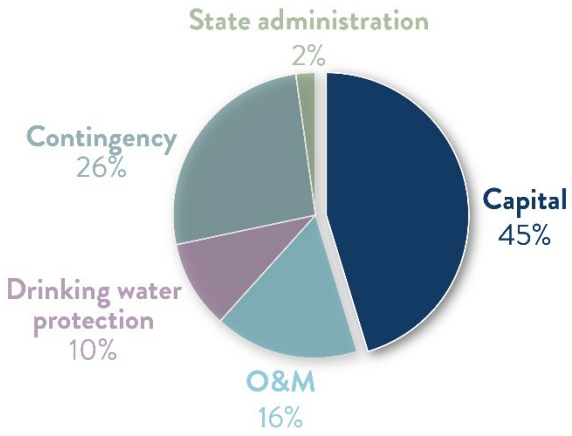
Figure 8.1. Allocation of $700 million in funding in the Final Plan. Percentages do not sum to 100% due to rounding.



4. $700 million is the amount of Settlement funding available after payment of legal fees and deducting the $20 million set aside for Priority 2. The Final Plan is based on the updated costs to address PFAS contamination, presented in Appendix E.

In addition to the three main funding priorities, 26% is reserved as a contingency for potential future treatment needs (including capital infrastructure and O&M), and 2% is set aside for the Co-Trustees to administer the plan into the future. Chapter 9 provides additional detail on the cost categories, and describes the methods and assumptions for the allocation of the $700 million.

8.2.1 Capital costs for drinking water supply and treatment fund allocation



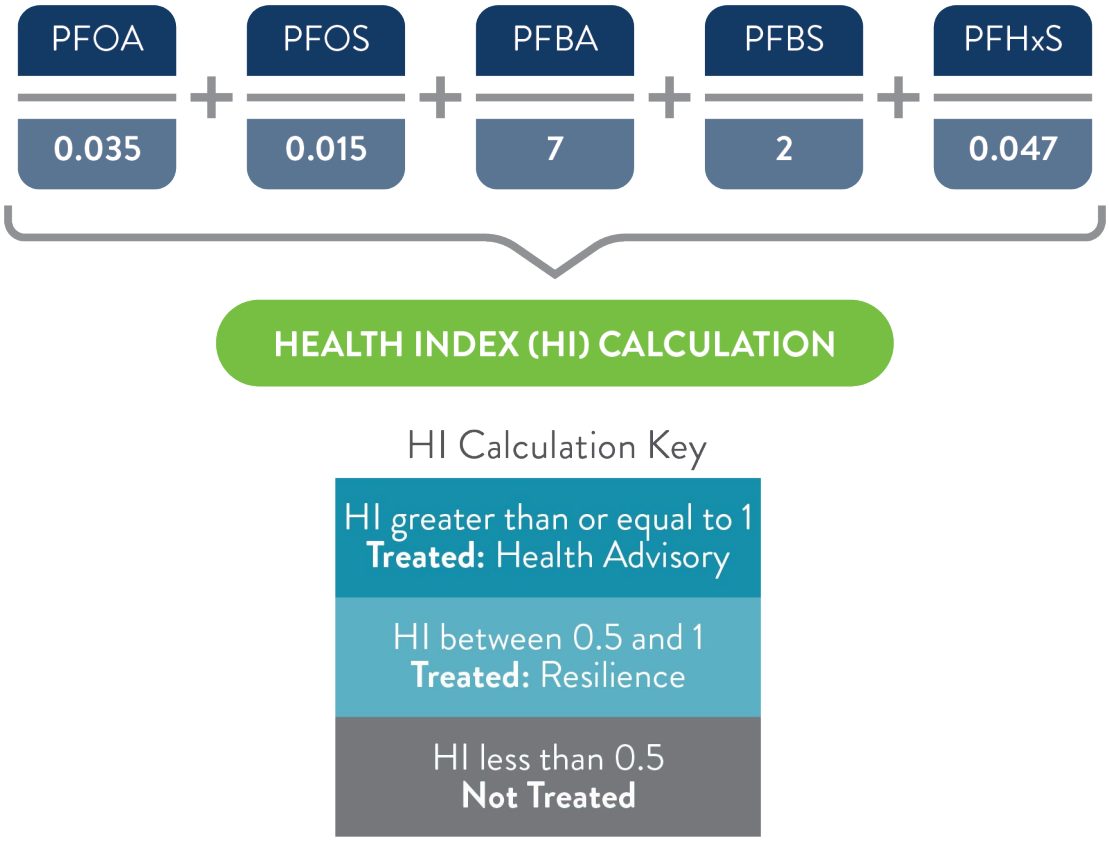
Capital costs are the costs to construct and install the drinking water supply and treatment infrastructure for public water systems and private wells that currently meet or exceed a Health Index (HI) of 0.5 (HI ≥ 0.5).

An HI is an indicator of risk due to exposure to multiple chemicals. It is determined by dividing the concentration of each chemical by its health-based water guidance value developed by the Minnesota Department of Health (MDH), which can be a health-based value (HBV) or a health risk limit (HRL), and then adding the resulting ratios for multiple chemicals. In the case of PFAS, the HI value takes into account the concentrations of five PFAS constituents: PFBS, PFBA, PFHxS, PFOS, and PFOA. The concentration of each constituent is divided by its HRL or HBV to calculate a ratio. The sum of these five ratios is the HI (Figure 8.2). As discussed in Chapter 7, an HI of 1 or greater indicates that one or more PFAS chemicals are present in sufficient concentrations to potentially have a health effect (for more information, visit health.state.mn.us/index.html). This would trigger a health advisory from MDH.

In Figure 8.2, the measured concentration of each PFAS constituent in parts per billion (shown in dark blue boxes) is divided by its HRL or HBV in parts per billion (shown in pale blue boxes), then the results are added together to calculate the HI. As shown in the HI Calculation Key below, if the HI is less than 0.5, the well will not be treated. If the HI is greater than or equal to 0.5, the well will be treated. The Final Plan uses a treatment threshold of HI ≥ 0.5 to provide resilience, which will help expedite addressing contamination and minimize costs of being reactive to changes in the future. Thus, the capital costs in the Final Plan include the costs to address wells that currently have a PFAS HI greater than or equal to (≥) 0.5. [5]

5. Some wells with HI values less than the treatment threshold may be treated if it is more efficient to do so, and if the well is likely to exceed the treatment threshold in the near future. For example, municipal water supply from all wells in a well field could receive treatment even though an individual well in the well field did not exceed the treatment threshold.

Figure 8.2. Illustration of HI calculation and treatment at the time of the release of the Final Plan. The measured concentration of each PFAS constituent in parts per billion (shown in dark blue boxes), is divided by its HRL or HBV in parts per billion (shown in green pale blue boxes), then added together to calculate the HI. As shown in the HI Calculation Key below, if the HI is less than 0.5, the well would not be treated or connected to a municipal system. If the HI is greater than or equal to 0.5, the well would be treated or connected to a public water supply system.



The capital costs allocation for drinking water supply and treatment projects includes costs to construct treatment facilities that use granulated active carbon (GAC) technology, based on the communities' projected 2040 demands. Communities may elect to use ion exchange (IX) instead of GAC if it is approved for use in Minnesota and if the cost is less than or similar to that of GAC. Capital costs also include the distribution system infrastructure to deliver treated water; new connections to municipal systems; required stormwater management infrastructure; groundwater pretreatment (if it is determined to be cost-effective);[6] city connection fees; and water treatment systems installed on the private well water line as it enters an individual home, for homes that are not connected to a municipal system (called point-of-entry treatment systems (POETSs)).

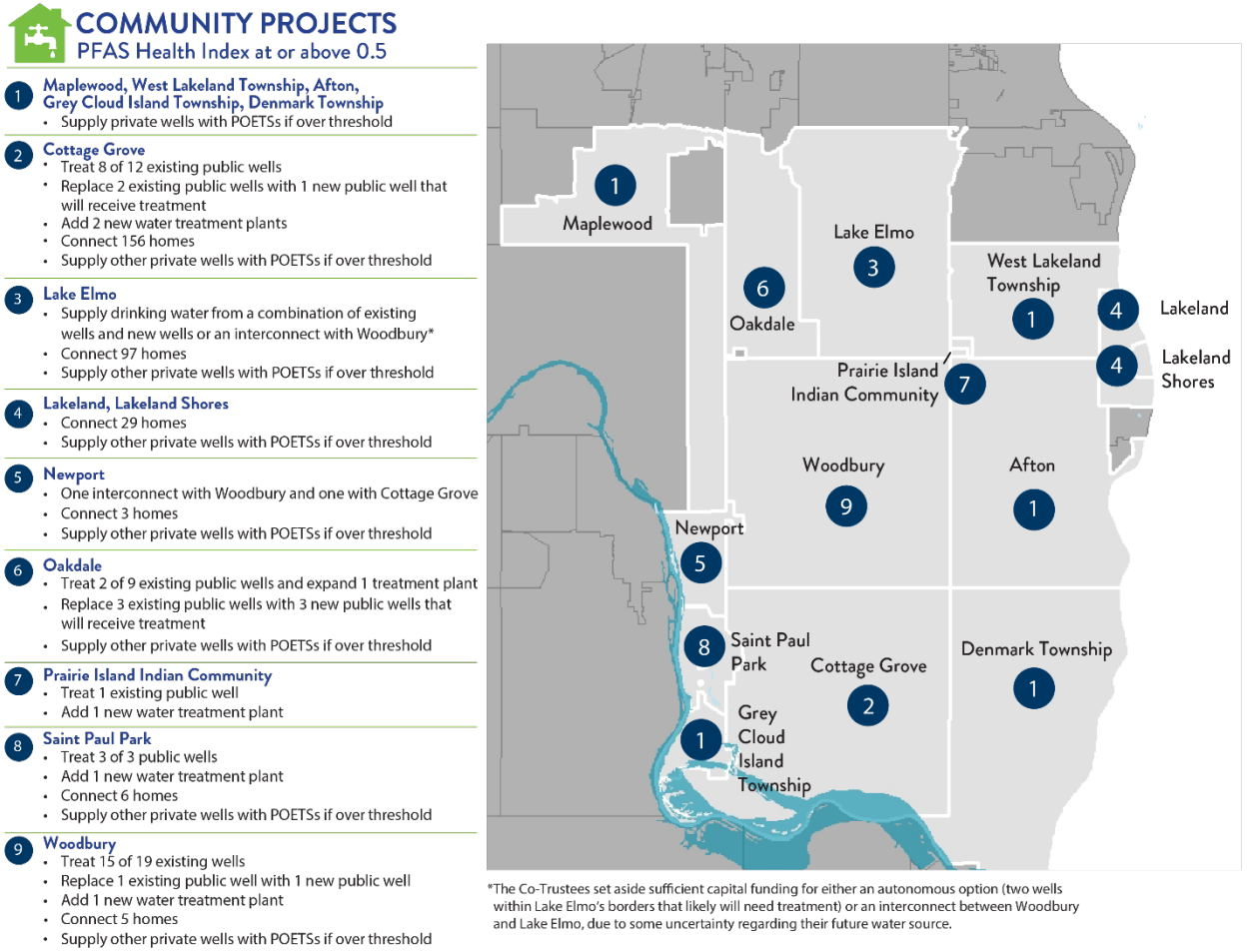
6. Elements such as iron and manganese in groundwater can interfere with PFAS treatment. Removing these elements before the PFAS treatment can extend the life of the PFAS treatment materials. Pretreatment would be implemented under this Plan only if it reduces long term O&M costs for the PFAS treatment systems. The Co-Trustees will evaluate and determine the cost-effectiveness of pretreatment on a case-by-case basis.

Specific drinking water infrastructure elements that are included in the Final Plan for each community are summarized in Figure 8.3, with additional detail on the elements for each community provided in Section 9.2. Improvements to and/or expansions of municipal treatment systems to address PFAS contamination (which include new or expanded treatment plants, connections of homes to public water supply, storage infrastructure, and interconnects between communities) will occur in Cottage Grove, Lake Elmo, Lakeland, Lakeland Shores, Newport, Oakdale, Prairie Island Indian Community, St. Paul Park, and Woodbury. Private wells throughout the affected communities that are not to be connected to municipal systems will be supplied with POETSs if they are over the treatment threshold. For detailed information on private well recommendations, please visit https://arcg.is/0fmHXS, where you can search by address.

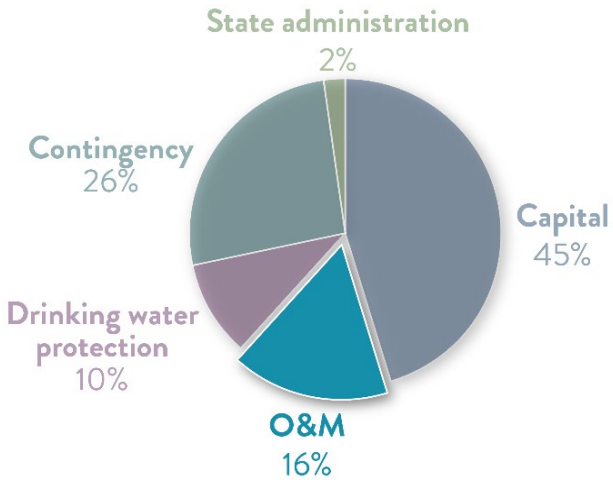
The costs for these infrastructure elements are based on the updated recommended options detailed in Appendix E that the Co-Trustees have determined are eligible for funding under the Settlement (see Section 9.2). Due to court decisions about White Bear Lake water levels and ongoing work to implement the court order, there is some uncertainty about Lake Elmo's future water source. The Co-Trustees will work with Lake Elmo to determine a reasonable solution within the constraints of the White Bear Lake decision. Thus, the Co-Trustees set aside sufficient capital funding for either an autonomous option (two wells within Lake Elmo's borders that likely will need treatment) or an interconnect between Woodbury and Lake Elmo. In West Lakeland, the Co-Trustees carefully considered two alternatives: a new municipal water system and the installation of in-home POETSs for wells that meet the treatment threshold. While both alternatives would ensure that all residents receive safe water into the future, POETSs are significantly more cost-effective. The Co-Trustees therefore selected the POETS alternative in the Final Plan. The Co-Trustees also considered the results of a survey conducted by West Lakeland, that suggested that a substantial number of residents do not want to connect to a municipal system.

The Final Plan is not designed to allocate the exact amount listed for each community (Section 9.2). Rather, it is intended to fund the actual expenses for the projects. As communities develop detailed designs and solicit bids for construction, Settlement-eligible costs may be higher or lower than the estimates. The Co-Trustees developed a funding reallocation strategy to outline how such differences in actual expenses will be addressed (Section 10.3). Additionally, communities are responsible for evaluating their plans and ensuring that they comply with federal, state, and local rules and regulations, and will only receive funding for plans that do so.

Figure 8.3. Community capital elements of Final Plan. Numbers of homes connected to municipal systems are estimates based on current information.



8.2.2 O&M fund allocation



The Co-Trustees allocated $115 million in funds for O&M of public water systems and POETSs for private wells. The breakdown of these costs included in the Final Plan is presented in Table 8.1. For additional information, refer to Section 9.3 and Appendix E.

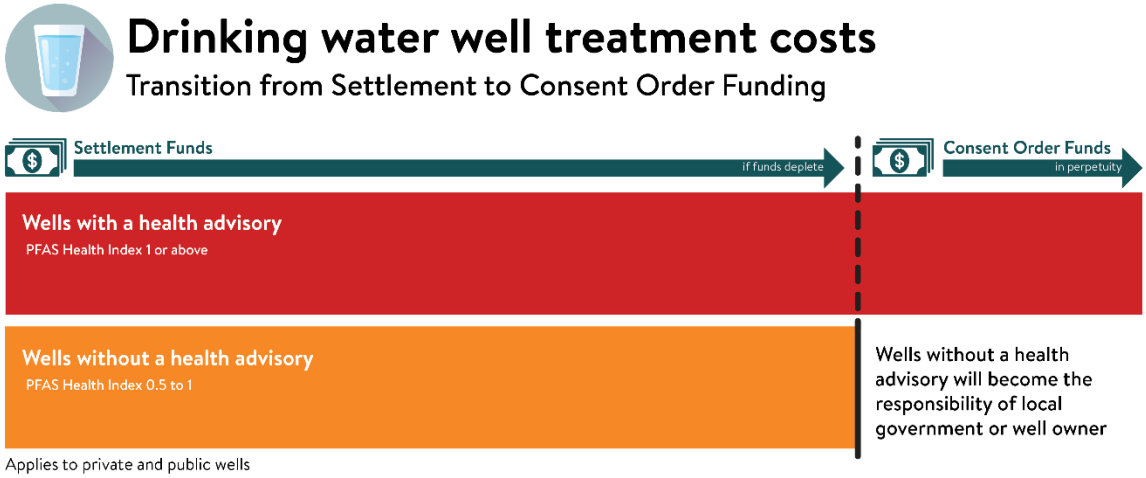
The O&M fund allocation for treatment of drinking water is intended to fund Settlement-eligible treatment-related costs for public water systems and POETSs at private wells. It includes treatment media change-out and the costs for facility O&M and city staff that are needed due to treatment. It will not be used to fund the non-PFAS-related expenses that are needed for having a municipal system, such as the O&M of distribution infrastructure.

Table 8.1. O&M cost breakdown.

Item	$ Million
O&M	$115
Public water systems	$87
POETSs	$28

When the Settlement is depleted, wells with a health advisory will continue to be treated by 3M under the 2007 Consent Order; but the Consent Order will not fund treatment of wells without a health advisory (Figure 8.4). It will be the responsibility of the local government or well owner to decide whether to continue to fund treatment of wells that do not have a health advisory.

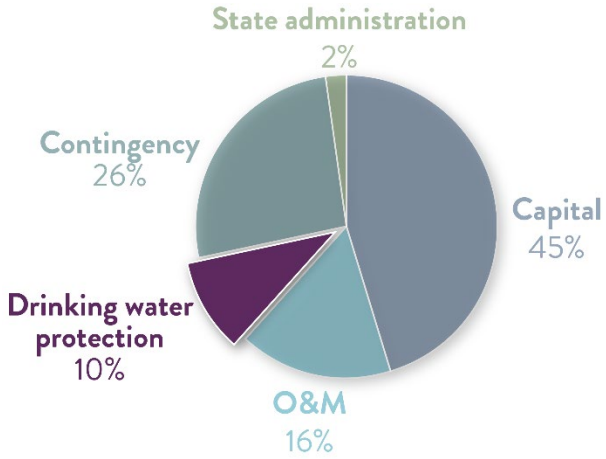
Figure 8.4. Drinking water well treatment costs; transition from Settlement to Consent Order funding.



The allocations of O&M funding are based on the estimated O&M costs for 20 years of public water supply and 30 years of private well POETSs. The goal is to provide funding for a sufficient period of time for communities and individuals with wells that do not have a health advisory to plan for the longer

term, should they wish to continue to treat their water once the Settlement funds are depleted. The longer timeframe for private wells recognizes the greater annual cost burden of maintenance for private well owners, which may result in many private well owners choosing not to continue treatment of wells that do not have a health advisory. It is anticipated that municipalities would be more financially able than private well owners to continue treatment. Settlement-eligible O&M costs will be funded in each community as they arise until this allocation is depleted. Depending on actual future inflation and the level of investment returns on funds, the number of years funded could differ from these estimates.

8.2.3 Drinking water protection fund allocation



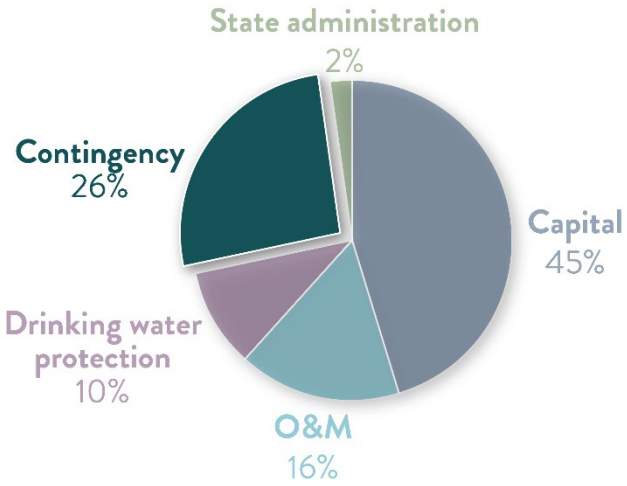
Drinking water protection is a component of Priority 1 of the Settlement and is also emphasized in the long-term goals for Priority 1 set out by the agencies and work groups at the beginning of this process. The Co-Trustees set aside $70 million to improve drinking water quality at the source. As such, this funding will target contamination cleanup to benefit drinking water quality for those wells negatively impacted by PFAS, help reduce future treatment needs by protecting wells that are currently not impacted by PFAS, and sustain the drinking water source for future generations. Drinking water protection projects will not replace remediation of the 3M Cottage Grove Site, the 3M Woodbury Disposal Site, and the 3M Oakdale Disposal Site, which remain the responsibility of 3M under the Settlement and 2007 Consent Order, and the Washington County Landfill, which is managed by MPCA's Closed Landfill Program.

The Co-Trustees are evaluating actions that will protect drinking water by reducing PFAS concentrations in groundwater and/or protect areas from migration of PFAS in the groundwater. One type of drinking water protection action may involve reducing PFAS plume movement by installing multi-benefit wells in targeted locations to directly remove PFAS from the groundwater, and reduce its migration (See Section 4.2.11). A portion of this treated water could then be used as a drinking water supply to nearby areas, with the remainder reinjected into the ground to maintain groundwater levels.

Recognizing the interaction between surface water and groundwater, drinking water protection efforts may also address impacted surface water and sediment that act as secondary sources of PFAS contamination to the drinking water supply. The Co-Trustees are currently evaluating PFAS impacts in soil, groundwater, surface water, sediments, and foam on surface water along the Project 1007/Raleigh Creek corridor and their impacts on drinking water. Drinking water protection actions could include targeted removals of PFAS-contaminated sediments or the removal of PFAS from surface water outside of the disposal areas, particularly as steps toward larger regional groundwater improvement goals.

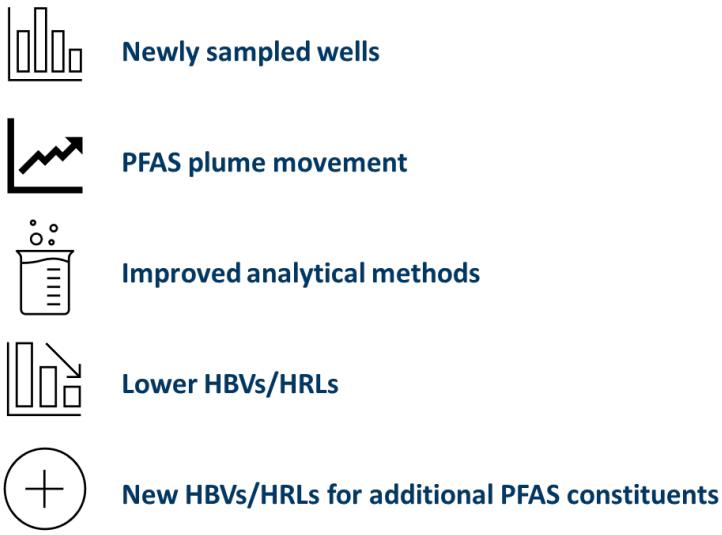
Using the results of the ongoing evaluations discussed above, the Co-Trustees will identify actions that are likely to yield the most benefit, and apply this funding to them.

8.2.4 Contingency fund allocation



The Co-Trustees have set aside $183 million in the Final Plan that may be used to fund several different areas of uncertainty. For instance, the contingency may be used to provide treatment for wells that are not included in the capital and O&M budgets of the Final Plan (Figure 8.5). Some wells in the East Metropolitan Area may not have been sampled to date. These wells may eventually be sampled and found to contain elevated PFAS. Additionally, as PFAS in groundwater migrate, concentrations may increase in some wells. In addition, as improvements are made in analytical methods, PFAS constituents could be measured at lower levels and where not detected before, which could increase the HI value for wells. Even in wells where the concentration does not increase over time, the HI could change as a result of new scientific information on toxicity of certain PFAS. The HBVs or HRLs for the current five PFAS compounds used to calculate the HI could be reduced, or HBVs or HRLs could be developed for additional PFAS compounds.

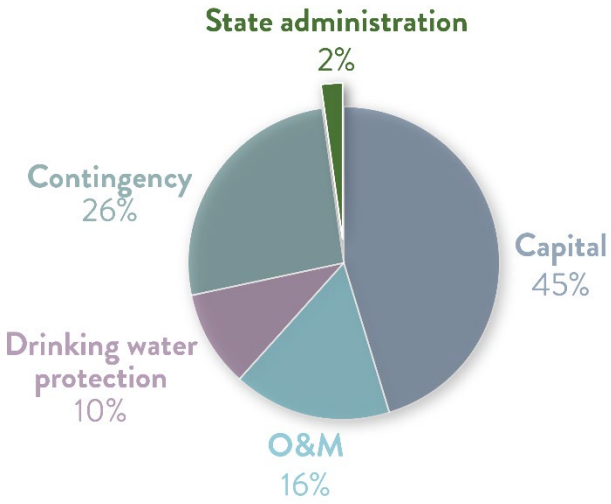
Figure 8.5. Situations that may cause additional wells to require treatment or municipal connection.



The contingency fund allocation may also be used to help PFAS-affected East Metropolitan Area communities fund the cost of providing an alternative source of water due to potential restrictions on use of aquifers that affect White Bear Lake levels. If an alternative water source is needed, this contingency fund could be used to help connect to St. Paul Regional Water Services (SPRWS) (See Section 9.4 for further discussion).

The Co-Trustees will determine what costs are eligible for funding by the contingency fund allocation based on the Settlement-eligible costs in the Final Plan and consistency with the framework of the Settlement and the Final Plan.

8.2.5 State administration fund allocation



The Co-Trustees have allocated $15 million for expenses to administer the Final Plan, including the state's work on reviewing funding requests and developing grant agreements, tracking project implementation progress, annual review and reallocation, reporting, preparing for and running public meetings; and the evaluation of Project 1007. The state administration fund allocation includes both state expenses and contractor support, and was based in part on past expenses.

8.3 Discussion

The Co-Trustees carefully considered the long-term program goals (see Box) in deciding how to finalize this plan. These goals were developed in collaboration with the work groups and reflect the collective priorities of the participants in this planning process. This section summarizes how the Final Plan addresses them.

Long-term program goals for Priority 1 – Drinking water quality, quantity, and sustainability

- Provide clean drinking water to residents and businesses to meet current and future needs under changing conditions, population, and HBVs.
- Protect and improve groundwater quality.
- Protect and maintain groundwater quantity.
- Minimize long-term cost burdens for communities.

8.3.1 Provide clean drinking water to residents and businesses to meet current and future needs under changing conditions, population, and HBVs

The Final Plan has allocated 88% of the available funding toward capital infrastructure, O&M, and contingency for potential future drinking water treatment. The cost estimates account for projected population growth to the year 2040 in the affected East Metropolitan Area communities.

The Settlement also states, "In selecting and performing activities pursuant to this paragraph, the State shall prioritize water supplies where health-based values, health risk limits, and/or health risk indices for PFCs are exceeded." The Final Plan achieves this requirement. An HI of 1 or greater indicates that one or more PFAS chemicals are present in sufficient concentrations to potentially have a health effect. The Final Plan will treat wells that currently meet a threshold of HI ≥ 0.5. The understanding of PFAS and the ability to detect it are continually evolving. As a result, PFAS HBVs or HRLs may change, or the extent of detectable PFAS contamination may change over time. Instead of being reactive to changes, the Final Plan builds a degree of resiliency to be able to proactively account for future potential changes. Further, the substantial contingency in the Final Plan will fund the provision of safe drinking water to additional areas if necessary and address uncertainties into the future.

8.3.2 Protect and improve groundwater quality

Protecting and improving groundwater quality helps ensure safe drinking water for generations to come. The Co-Trustees are committed to a long-term comprehensive approach to address PFAS. The $70 million allocated for these efforts will aim to both reduce PFAS impacts in the drinking water source itself (groundwater) and reduce additional groundwater contamination from surface water and sediment that are known to be contaminated with PFAS. These efforts will reduce the need for drinking water treatment in the long term and help prevent additional wells from needing treatment. In turn, this could extend the life of the Settlement funds for treatment where it is needed.

8.3.3 Protect and maintain groundwater quantity

The Final Plan maintains a sustainable long-term groundwater supply. The steady-state groundwater modeling analysis evaluated projected groundwater elevations and aquifer yield using 2040 projected demand and simulated drought conditions. Based on the locations and volumes of projected water demand, the analysis indicates that the aquifers are capable of sustaining this level of pumping over the long term without adversely affecting the aquifer.

Although the Final Plan, overall, is not expected to adversely affect groundwater levels, portions of the North and East Metro area are subject to court-ordered restrictions to maintain lake levels in White Bear Lake. The Final Plan includes contingency funding that could be used to help move certain PFAS-affected East Metropolitan communities in this area to a surface water source (i.e., SPRWS) should it be necessary to ensure compliance with the court order.

8.3.4 Minimize long-term cost burdens for communities

The Final Plan prioritizes Settlement funding to provide safe drinking water to the affected East Metropolitan Area communities. The Co-Trustees worked with the communities to identify their costs and concerns, and based funding for O&M on estimated costs for public water systems for 20 years and for POETSs at private wells for 30 years, although the timeframe will depend on actual future inflation and the level of investment returns on funds. When the Settlement funds are depleted, O&M for treatment on municipal or private wells that have a health advisory associated with PFAS will be funded under the Consent Order. It will be the responsibility of the local government or well owner to decide whether to continue to fund treatment of wells that do not have a health advisory.

9. Details on the Final Plan and fund allocations

9.1 Introduction

The Final Plan allocates $700 million from the Settlement to different categories presented in Chapter 8. Chapter 6 and Appendix E contain the cost estimates used as the starting point for the fund allocations in the draft recommended options and, ultimately, in the Final Plan. Based on input from the work groups, communities, and general public, the Co-Trustees made a series of decisions about the types of drinking water infrastructure costs that will be eligible for Settlement funding. Those decisions determined the amount of funding for capital and operations and maintenance (O&M) that is necessary from the Settlement.

In addition, the Co-Trustees evaluated options for allocating Settlement funds to other purposes, including contingency for future uncertainties, drinking water protection, and state administration. The Co-Trustees set allocations to these purposes while keeping the overall allocation equal to the total amount of funds available (i.e., $700 million). This chapter describes the methods and assumptions used for fund allocations, including details about what is included under each allocation.

9.2 Capital fund allocation

Capital costs are broken into three categories: drinking water infrastructure, pretreatment infrastructure, and inflation.

9.2.1 Drinking water infrastructure

Drinking water infrastructure includes treatment facilities using granular activated carbon (GAC), distribution system infrastructure to deliver treated water to newly connected homes and businesses, property acquisition for new treatment and other facilities, and lateral connections to homes and businesses that will be connected to municipal water systems. In addition, this category includes whole home treatment systems (referred to as POETSs elsewhere in this plan) for homes with affected wells that will not be connected to a municipal water system. This category also includes stormwater management measures required for many of the drinking water construction projects. Finally, this category includes various city connection fees incurred when homes or businesses are first connected to their municipal water system (e.g., connection fees, tap fees, and water availability charges).

Co-Trustees determined the types of projects that would be eligible for Settlement funding by following the guidelines described in Section 6.1.2. Only projects that are necessary due to PFAS contamination are considered eligible. The full list of all eligible drinking water project types is shown below:

- Point of entry treatment systems (POETSs)
- Water treatment plants
- Land acquisition for treatment plants
- Water treatment plant site preparation
- Sewer lines from water treatment plants
- Demolition of municipal wells to be replaced
- New wells and well modifications
- Raw water transmission mains
- Distribution mains
- Service laterals for home connections
- City connection fees
- Interconnects
- Booster pump stations
- Booster pump station upgrades
- Storage tanks
- Capacity for fire protection
- Pressure reducing valves
- Private well sealing
- Removal of existing POETSs
- Demolition of temporary treatment facilities
- Stormwater compliance measures

Co-Trustees determined that some infrastructure items would not be funded by the Settlement because they are needed for reasons other than the PFAS contamination (e.g., projects that are needed solely due to growth). Items that are not considered eligible for Settlement funding are listed below.

- Additional treatment below the treatment threshold of HI ≥ 0.5
- Projects that are meant to serve growth, including expansion of water mains, adding storage tanks or other distribution system infrastructure, and new wells
- Treatment required for chemicals other than PFAS (e.g., trichloroethylene, or TCE)
- New developments, and water main extensions to those neighborhoods

If new items other than those listed above are identified during project implementation the Co-Trustees will apply eligibility guidelines to determine whether they will be funded by the Settlement.

Out of the total $317 million for capital, the total amount allocated to drinking water infrastructure is about $276 million. Tables 9.1 to 9.13 summarize the capital projects for each community that will be funded by the Settlement under the Final Plan. The Co-Trustees have determined that the projects and costs summarized in Tables 9.1 to 9.13 are eligible for funding under the Settlement. The plan does not guarantee that each community will be allocated the exact amount estimated for eligible projects. As part of implementation of the plan, communities will develop detailed designs for these projects and solicit bids for construction. If actual project costs are lower than the estimates in this plan, the Settlement will fund the actual costs. If communities find that costs are higher than the estimates in this plan, or if capital projects items need to be added or modified, the Co-Trustees will work with communities to evaluate those changes for Settlement eligibility and update fund allocations as necessary. Chapter 10 describes the Co-Trustees' strategy for fund reallocation. Information shown in the tables below is based on estimates, and could change slightly during the implementation process.

Some projects were approved and funded during the process of developing the Conceptual Plan. Co-Trustees established a procedure for communities to apply for expedited funding to take advantage of ongoing construction and achieve cost savings. For example, in connecting a neighborhood where wells are contaminated by PFAS, costs are saved by constructing the necessary water mains while roads are already under construction. Projects approved for expedited funding are consistent with the goals of the Settlement, and would likely have been implemented under the Final Plan. In addition, these projects were reviewed by the work groups prior to approval. Expedited projects have been mostly funded with interest earnings on the Settlement. If the total for completed and on-going expedited projects exceeds interest earnings, the contingency fund (see below) will be reduced to fund the cost. A total of

$34.3 million was provided for 12 expedited projects in Cottage Grove, Lake Elmo, Oakdale, and Woodbury. Details are provided in Tables 9.2b, 9.5b, 9.9b and 9.13b.

Table 9.1. Summary of the Final Plan for Afton. Details can be found in Appendix E, Table E.8. Details and costs are based on best estimates at the time the plan was developed.

Capital project category	Details for Afton	Total cost in the Final Plan
Capital and O&M for POETSs installed since the Settlement	39 existing POETSs	$169,000
Estimated new GAC POETSs	13 estimated new POETSs	$32,500
Contingency	25% added for contingency	$8,125
Professional services	15% added for professional services	$4,875
	Total capital	**$214,500**

Table 9.2a. Summary of the Final Plan for Cottage Grove. Details can be found in Appendix E, Table E.12. Details and costs are based on best estimates at the time the plan was developed.

Capital project category	Details for Cottage Grove	Total cost in the Final Plan
Capital and O&M for POETSs installed since the Settlement	32 existing POETSs	$156,000
Estimated new GAC POETSs	49 estimated new POETSs	$122,500
Treatment on municipal wells	2 WTPs and 1 sewer line to convey backwash	$21,265,750
New wells and well modifications	1 replacement well for wells 1 and 2; modifications and SCADA upgrades for 9 wells	$3,978,000
Distribution system	3.7 miles of raw water mains, 67 neighborhood mains and home connections (i.e., service laterals); 16" distribution line to grange tank	$11,408,918
Land acquisition	12.3 acres for treatment plants and easements for mains	$4,429,510
Stormwater compliance	Stormwater costs 5% of linear and facility projects	$1,691,733
Other	Municipal well sealing and demolition; private well sealing; existing GAC POETSs removal; City connection fees	$2,161,800
Contingency	25% added for contingency	$11,264,553
Professional services	15% added for professional services	$6,758,732
	Total capital	**$63,237,496**

Table 9.2b. Approved expedited projects for Cottage Grove.

Details on expedited project	Approved cost
Extend the water main in the River Acres neighborhood to connect 123 homes to the city's municipal drinking water supply system	$8,800,000
Connect 36 homes in the Granada Avenue neighborhood to the city's municipal drinking water supply system	$2,250,000
Total for expedited projects	**$11,050,000**

Table 9.3. Summary of the Final Plan for Denmark. Details can be found in Appendix E, Table E.15. Details and costs are based on best estimates at the time the plan was developed.

Capital project category	Details for Denmark	Total cost in the Final Plan
Estimated new GAC POETSs	4 estimated new POETSs	$10,000
Contingency	25% added for contingency	$2,500
Professional services	15% added for professional services	$1,500
	Total capital	**$14,000**

Table 9.4. Summary of the Final Plan for Grey Cloud Island. Details can be found in Appendix E, Table E.16. Details and costs are based on best estimates at the time the plan was developed.

Capital project category	Details for Grey Cloud Island	Total cost in the Final Plan
Capital and O&M for POETSs installed since the Settlement	8 existing POETSs	$38,000
Estimated new GAC POETSs	23 estimated new POETSs	$57,500
Contingency	25% added for contingency	$14,375
Professional services	15% added for professional services	$8,625
	Total capital	**$118,500**

Due to court decisions about White Bear Lake water levels and ongoing work to implement the court order, there is some uncertainty about Lake Elmo's future water source. As a result, the Co-Trustees considered two alternatives for Lake Elmo. One alternative involves Lake Elmo having an autonomous water supply by installing two additional groundwater supply wells within Lake Elmo, and adding treatment for those wells if necessary. The other alternative involves an interconnect between Woodbury and Lake Elmo and three new wells in Woodbury to provide water for Lake Elmo. At this time, a final selection has not been made between the two alternatives. To be conservative in the fund allocations, Co-Trustees budgeted for the alternative with the greater capital costs, which is the Woodbury- Lake Elmo Interconnect. In addition, the funding for contingency (see section 9.5) could also be used for alternative water sources for Lake Elmo.

Table 9.5a. Summary of the Final Plan for Lake Elmo. Details can be found in Appendix E, Table E.20. Details and costs are based on best estimates at the time the plan was developed. (Line items may not sum to the total shown due to rounding.)

Capital project category	Details for Lake Elmo	Total cost in the Final Plan
Capital and O&M for POETSs installed since the Settlement	7 existing POETSs	$27,500
Estimated new GAC POETSs	18 estimated new POETSs	$45,000
Interconnect and booster pump station	1 interconnect station and 1 booster pump station for Woodbury to Lake Elmo	$2,075,500
Distribution system	2.37 miles of neighborhood distribution mains in Lake Elmo for 257 homes; 3.59 miles of transmission or connecting mains; 0.48 miles of raw water distribution mains; 800 linear feet of mains from distribution system to booster pump station; connections for 97 homes in Lake Elmo (i.e., service laterals)	$12,810,369

Capital project category	Details for Lake Elmo	Total cost in the Final Plan
Land acquisition	12.4 acres in Lake Elmo and 1.8 acres in Woodbury	$2,820,289
Stormwater compliance	Stormwater costs 30% of linear and facility projects in Lake Elmo and 25% of projects in Woodbury	$4,166,639
Other	97 private well sealings; removal of 25 existing POETSs; City fees for new connections	$809,280
Contingency	25% added for contingency	$5,681,769
Professional services	15% added for professional services	$3,409,062
	Total capital	**$31,845,409**

Table 9.5b. Approved expedited projects for Lake Elmo.

Details on expedited project	Approved cost
Extend a municipal water supply system to 61 homes located in the Lake Elmo Parkview	$5,200,000
Extend a municipal water supply system to 65 homes located in the Stonegate 1st and 2nd addition neighborhoods	$4,384,300
Extend a municipal water supply system to 48 homes located in 38th and 39th Street neighborhood	$3,984,000
Extend a municipal water supply system to six homes located just east of 31st Street and south of Stillwater Boulevard	$549,100
Extend a municipal water supply system to 44 homes located in the Whistling Valley neighborhood	$3,660,000
Extend a municipal water supply system to 41 homes located in the Hamlet on Sunfish Lake neighborhood	$2,712,200
Extend a municipal water supply system to 23 homes located in the Torres Pines neighborhood	$2,219,000
Extend municipal line east from the Tapestry neighborhood to connect 1 home	$52,000
Total for expedited projects	**$22,760,600**

Table 9.6. Summary of the Final Plan for Lakeland and Lakeland Shores. Details can be found in Appendix E, Table E.30. Details and costs are based on best estimates at the time the plan was developed.

Capital project category	Details for Lakeland, Lakeland Shores	Total cost in the Final Plan
Capital and O&M for POETSs installed since the Settlement	1 existing POETS	$4,500
Distribution system	Connecting 29 homes to existing mains (i.e., service laterals)	$144,275
Other	Removal of 4 existing POETSs; sealing 309 private wells; City fees for new connections	$859,825
Contingency	25% added for contingency	$251,025
Professional services	15% added for professional services	$150,615
	Total capital	**$1,410,240**

Table 9.7. Summary of the Final Plan for Maplewood. Details can be found in Appendix E, Table E.32. Details and costs are based on best estimates at the time the plan was developed.

Capital project category	Details for Maplewood	Total cost in the Final Plan
GAC POETSs	5 estimated new POETSs	$12,500
Contingency	25% added for contingency	$3,125
Professional services	15% added for professional services	$1,875
	Total capital	**$17,500**

Previous recommended options included costs for one interconnect for Newport in order to support their public water supply system in the future should it become necessary due to PFAS impacts. Discussions between the city and the Co-Trustees led to the decision to include costs for a second interconnect in order to provide resiliency and an alternative water supply for the city. If Newport's wells become contaminated with PFAS in the future, the city would prefer to receive water via one or both of these interconnects rather than implement treatment on their wells. If Newport eventually receives its water from interconnects, the state will require the city to seal its two municipal wells.

Table 9.8. Summary of the Final Plan for Newport. Details can be found in Appendix E, Table E.34. Details and costs are based on best estimates at the time the plan was developed.

Capital project category	Details for Newport	Total cost in the Final Plan
Estimated new GAC POETSs	6 estimated new POETSs	$15,000
Interconnect stations	1 interconnect station with Woodbury and 1 interconnect station with Cottage Grove	$400,000
Distribution system	0.51 miles of interconnect mains with Woodbury; 0.76 miles of interconnect mains with Cottage Grove; connecting 3 homes to existing mains (i.e., service laterals)	$1,134,700
Land acquisition	1.5 acres for water main easements	$208,370
Stormwater compliance	Stormwater costs 5% of linear and facility projects	$75,610
Other	Demolition of 2 municipal wells; sealing 3 wells; removal of 1 existing POETSs; City fees for new connections	$274,200
Contingency	25% added for contingency	$526,970
Professional services	15% added for professional services	$316,182
	Total capital	**$2,951,032**

Table 9.9a. Summary of the Final Plan for Oakdale. Details can be found in Appendix E, Table E.39. Details and costs are based on best estimates at the time the plan was developed.

Capital project category	Details for Oakdale	Total cost in the Final Plan
Treatment on municipal wells	1 WTP	$5,890,000
New wells and well modifications	3 new wells to replace wells 1, 2, and 7; well and SCADA upgrades to 2 wells	$6,934,000
Distribution system	0.53 miles of raw water transmission mains, 4 home connections (i.e., service laterals)	$1,135,942
Land acquisition	3.1 acres for treatment plants and easements for mains	$561,875
Stormwater compliance	Stormwater costs 5% of linear and facility projects	$2,483,983

Capital project category	Details for Oakdale	Total cost in the Final Plan
Other	Demolition and sealing of 4 municipal wells; demolition of temporary treatment facility at well 7; WTP site prep; City fees for new connections	$1,284,920
Contingency	25% added for contingency	$4,572,680
Professional services	15% added for professional services	$2,743,608
	Total capital	**$25,607,008**

Table 9.9b. Approved expedited projects for Oakdale.

Details on expedited project	Approved cost
Conducted a feasibility study to evaluate treatment locations for its four city wells that received well advisories. The study will determine whether there is sufficient space for a temporary or permanent treatment facility at the well location or at a centralized location.	$20,000
Total for expedited projects	**$20,000**

Table 9.10. Summary of the Final Plan for Prairie Island Indian Community. Details can be found in Appendix E, Table E.44. Details and costs are based on best estimates at the time the plan was developed. (Line items may not sum to the total shown due to rounding.)

Capital project category	Details for Prairie Island Indian Community	Total cost in the Final Plan
Treatment on municipal wells	1 WTP	$1,734,956
New wells and well modifications	Well upgrades to 1 well	$113,250
Distribution system	1.66 miles of mains; 80 home connections (i.e., service laterals); 1 60k gallon storage tank	$2,022,610
Land acquisition	1.5 acres for WTP site and easements for distribution mains	$211,702
Stormwater compliance	Stormwater costs 30% of linear and facility projects	$1,043,270
Contingency	25% added for contingency	$1,281,447
Professional services	15% added for professional services	$768,868
	Total capital	**$7,176,102**

Table 9.11. Summary of the Final Plan for St. Paul Park. Details can be found in Appendix E, Table E.47. Details and costs are based on best estimates at the time the plan was developed. (Line items may not sum to the total shown due to rounding.)

Capital project category	Details for St. Paul Park	Total cost in the Final Plan
Capital and O&M for POETSs installed since the Settlement	4 existing POETSs	$21,000
Treatment on municipal wells	1 WTP	$5,706,804
New wells and well modifications	Well & SCADA upgrades to 3 wells	$600,000

Capital project category	Details for St. Paul Park	Total cost in the Final Plan
Distribution system	0.61 miles of raw water transmission mains; 1.05 miles of water distribution mains; 6 home connections (i.e., service laterals)	$4,098,617
Land acquisition	3 acres for WTP site and water main easements	$408,592
Stormwater compliance	Stormwater costs 5% of linear and facility projects	$488,021
Other	Sealing 6 wells; removing 1 existing POETSs; City fees for new connections	$26,110
Contingency	25% added for contingency	$2,832,036
Professional services	15% added for professional services	$1,699,222
	Total capital	**$15,880,401**

The Co-Trustees considered two alternatives for West Lakeland: a new municipal water system and the installation of whole home treatment systems for wells that meet the treatment threshold. Both alternatives ensure that all residents receive safe water now and into the future; however, a new municipal system would be substantially more expensive than POETSs, adding roughly $179 million in additional capital costs. Settlement-eligible annual O&M costs for a new municipal system would be slightly lower than the cost to maintain a POETS for every home with HI above the treatment threshold. The Co-Trustees analyzed how long it would take for the cost of installing and maintaining POETSs to exceed the total capital and O&M costs of the municipal system. Assuming 3% inflation on O&M costs and 3.5% interest earnings on funds set aside for O&M, the analysis found that it would take at least 300 years for the cost of POETSs to exceed the cost of the municipal water system.

West Lakeland surveyed their residents and the results suggest that a substantial number of residents would not want to connect to the municipal system. Co-Trustees received feedback from a significant number of residents of West Lakeland expressing a preference to keep their private well and receive a POETS. The Co-Trustees concluded that, despite some benefits of a municipal water system, implementing POETSs for affected homes would continue to be an effective strategy to ensure safe drinking water and POETSs would be more cost-effective than a new municipal system. The costs shown in Table 9.12 reflect the implementation of POETSs and do not include the option to implement a new municipal water system.

Table 9.12. Summary of the Final Plan for West Lakeland. Details can be found in Appendix E, Table E.50. Details and costs are based on best estimates at the time the plan was developed.

Capital project category	Details for West Lakeland	Total cost in the Final Plan
Capital and O&M for POETSs installed since the Settlement	412 existing POETSs	$1,958,000
Estimated new GAC POETSs	103 estimated new POETSs	$257,500
Contingency	25% added for contingency	$64,375
Professional services	15% added for professional services	$38,625
	Total Capital	**$2,318,500**

Table 9.13a. Summary of the Final Plan for Woodbury. Details can be found in Appendix E, Table E.60. Details and costs are based on best estimates at the time the plan was developed.

Capital project category	Details for Woodbury	Total cost in the Final Plan
Capital and O&M for POETSs installed since the Settlement	1 existing POETs	$3,500
Estimated new GAC POETSs	18 estimated new POETSs	$45,000
Treatment on municipal wells	1 WTP and sewer line to convey backwash	$20,502,800
New wells and well modifications	Replacement for Well 1 in South Well Field and well & SCADA upgrades for 15 wells	$5,178,000
Distribution system	12.81 miles of mains, 5 home connections (i.e., service laterals); 2 pressure reducing valves	$41,345,394
Land acquisition	16 acres for treatment plants and easements for mains	$6,709,000
Stormwater compliance	Stormwater costs 25% of linear and facility projects	$15,458,299
Other	Municipal well sealing and demolition; private well sealing; City connection fees	$151,115
Contingency	25% added for contingency	$22,347,402
Professional services	15% added for professional services	$13,408,441
	Total capital	**$125,148,951**

Table 9.13b. Approved expedited projects for Woodbury.

Details on expedited project	Approved cost
Conduct a feasibility study to better understand the city's existing water supply distribution as it relates to PFAS contamination	$96,069
Total for expedited projects	**$96,069**

9.2.2 Pretreatment infrastructure

Pretreatment is a separate category of capital costs that will be used only if it can be shown to be a cost-effective way to reduce the treatment O&M costs funded by the Settlement. Co-Trustees will work with communities to evaluate the costs and benefits of pretreatment as part of the implementation process and to determine whether and where it would be most cost-beneficial to implement.

In systems with elevated levels of metals in their groundwater, such as iron and manganese, removing these elements prior to treatment with GAC or ion exchange (IX) can extend the life of the treatment media and reduce O&M costs. Further discussion of these costs is provided in Appendix F, Section F.7. Available data suggests that the need for pretreatment may be limited; only Woodbury, Cottage Grove, and Saint Paul Park have concentrations of metals in their source water that approach levels where pretreatment might be cost-effective.

The Co-Trustees set aside $25 million for pretreatment capital costs. O&M costs for pretreatment are not included in the Final Plan because pretreatment will be implemented only if it reduces O&M costs. If pretreatment is not shown to be cost-effective for any community, these funds will be reallocated following the strategy laid out in Chapter 10. Similarly, if additional pretreatment funds are needed, it will be evaluated based on the reallocation strategy in Chapter 10.

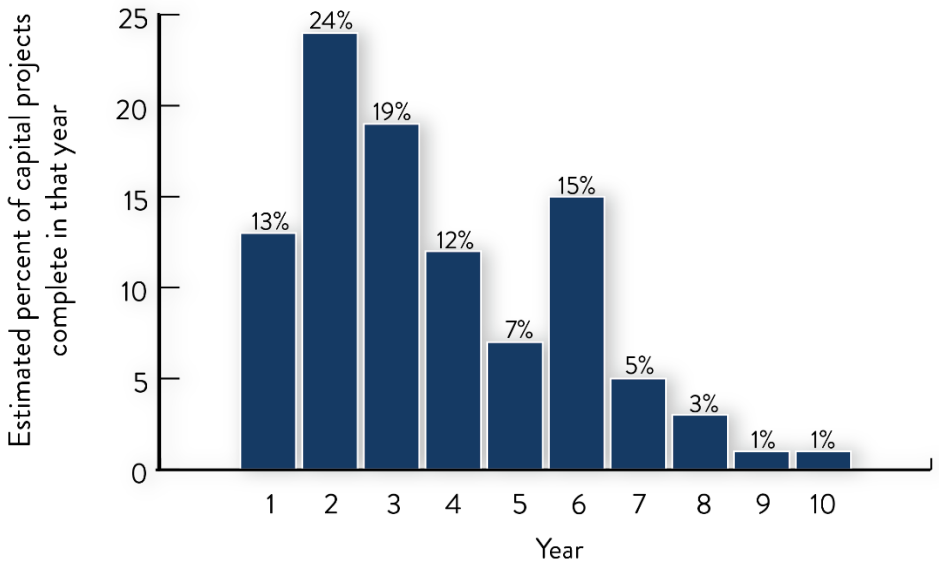
9.2.3 Inflation

Construction of capital projects under the Conceptual Plan may require 10 or more years to complete. Costs for materials and labor are very likely to increase over this time due to anticipated construction sector inflation. Currently, Settlement funds are in an interest-bearing account, but the earnings are not expected to keep pace with inflation. Co-Trustees set aside additional funds to cover potential future inflation of costs, separate from the 25% contingency built into capital cost estimates. The allocation for inflation assumes 3% annual inflation and 1% annual earnings for funds allocated to capital projects. Any interest earned on funds set aside for capital will be used for capital expenses.

The assumed inflation rate is based on information from past inflation trends, and professional judgment among the technical team that developed the Conceptual Plan. The assumed interest rate is based on recent earnings on the Settlement fund. Both assumptions were reviewed by the State Board of Investment and are consistent with their recommendations.

Based on information from communities, Co-Trustees developed an estimate of annual capital spending over the next 10 years (see Figure 9.1). This schedule, together with inflation and interest estimates, determines how much additional funding should be set aside to fund future costs with anticipated inflation. For the calculation, it is assumed that each annual increment of capital costs is withdrawn at the start of each year, and interest is then applied to the remaining balance in the fund. In addition, it is assumed that there is no inflation for costs incurred at the beginning of the first year. The Co-Trustees set aside $16 million to cover inflation.

Figure 9.1. Estimated capital spending by year under the Conceptual Plan. Some projects may require additional planning and evaluation and may not start construction until year 6.



9.2.4 Uncertainty in capital costs and fund allocations

There is some uncertainty in estimated capital costs. Appendix E describes the cost estimates as having a -30% to +50% range of accuracy. To guard against the risk of actual costs being higher than the estimates, a 25% contingency is added. In addition to uncertainty about the cost estimates, unforeseen requirements may arise as communities implement drinking water infrastructure projects that may introduce additional costs.

The Co-Trustees will evaluate updated estimates and previously unidentified costs, such as reimbursement for park land, as they arise during implementation. If new costs are funded by the Settlement, Co-Trustees will consider whether additional funds will be reallocated from other purposes following the strategy described in Chapter 10.

9.3 Operation and maintenance fund allocation

For purposes of the fund allocation, O&M costs are broken into two categories: municipal water systems and POETSs.

9.3.1 Municipal water system O&M

Municipal water system O&M costs that are eligible for Settlement funding include media change-outs for GAC or IX, costs for personnel to operate the system, and maintenance on buildings that contain treatment systems. O&M for new distribution systems (e.g., water mains) are not eligible for Settlement funding. Finally, replacement costs for treatment, or distribution systems, are not eligible for Settlement funding.

Allocations were set using 3% annual inflation and 3.5% annual interest to estimate the duration of annual O&M that would be funded by a given dollar allocation. It is assumed that the full amount of annual O&M will begin immediately. In reality, O&M costs will likely ramp up over a period of years,[7] but at this stage Co-Trustees lack sufficient information to project the ramp-up. Inflation is not applied to O&M costs in year 1. Each year's increment of O&M cost is assumed to be paid out at the beginning of the year, and interest is then applied to the remaining balance in the fund. Table 9.14 provides a sample of annual O&M costs, interest earnings, and fund balance. Co-Trustees allocated $87 million to fund O&M for municipal water systems.

The $87 million allocation is based on funding 20 years of annual treatment O&M costs together with 3% inflation and 3.5% interest; however, the actual duration could differ if inflation and interest earnings are higher or lower, or if costs differ from current estimates. Settlement-eligible O&M costs will be funded in each community as they arise until this allocation of $87 million is depleted. Once this allocation is depleted, it is expected that under the Consent Order 3M will fund O&M costs for treatment on wells with a health advisory from MDH (i.e., wells with HI≥1), while communities will be responsible for O&M costs for treatment on wells that do not have an MDH health advisory, should they choose to continue to treat them.

The $87 million allocation was determined by the Co-Trustees in order to balance capital and long-term costs that would be funded by communities, contingency funds for uncertainties, and drinking water protection. The Co-Trustees aimed to provide as much funding for annual O&M costs as possible given the capital cost estimates and the priority to allocate funds for future uncertainties and for drinking water protection.

7. Under the Settlement agreement, 3M funds costs for temporary treatment systems for up to 5 years from the Settlement date, or $40 million of total cost, whichever comes first. After the 5 years or $40 million, the Settlement will fund the cost of temporary systems if permanent solutions are not yet in place.

Table 9.14. Sample of annual O&M costs for municipal water systems, interest earnings, and fund balance.

Year	Fund balance, beginning of year	Annual O&M cost, with inflation	Annual interest on funds remaining after O&M expenses	Fund balance at end of year, after O&M cost and interest earnings
1	$87.00	$4.52	$2.89	$85.37
2	$85.37	$4.65	$2.82	$83.54
3	$83.54	$4.79	$2.76	$81.50
4	$81.50	$4.94	$2.68	$79.24
5	$79.24	$5.09	$2.60	$76.75
6	$76.75	$5.24	$2.50	$74.01
7	$74.01	$5.40	$2.40	$71.02
8	$71.02	$5.56	$2.29	$67.75
9	$67.75	$5.72	$2.17	$64.20
10	$64.20	$5.90	$2.04	$60.34

9.3.2 O&M for POETSs

Annual O&M funding for POETSs funds changing out filtration media once a year. The allocation for POETSs O&M assumes 3% annual inflation and 3.5% annual interest to estimate the duration of annual O&M that would be funded by a given dollar allocation. It is assumed that the full amount of annual O&M will begin immediately. In reality, O&M costs will likely ramp up over a period of years as new POETSs are installed, but at this stage Co-Trustees lack sufficient information to project exactly how O&M costs will ramp up. Inflation is not applied to O&M costs in year 1. Each year's increment of O&M cost is assumed to be paid out at the beginning of the year, and interest is then applied to the remaining balance in the fund.

Co-Trustees allocated $28 million to fund POETS O&M. The allocation is based on funding 30 years of annual O&M costs for POETSs together with 3% inflation and 3.5% interest; however, the actual duration could differ if inflation and interest earnings are higher or lower, or if costs differ from current estimates. O&M costs for POETSs will be funded as they arise until this allocation of $28 million is depleted. Table 9.15 provides a sample of annual O&M costs, interest earnings, and fund balance.

This allocation was determined by the Co-Trustees in order to minimize costs for individual homeowners, while balancing capital and long-term costs that would be funded by communities, contingency funds for uncertainties, and drinking water protection. The Co-Trustees aimed to provide as much funding for annual POETS O&M costs as possible given the capital cost estimates and the priority to allocate funds for future uncertainties and for drinking water protection.

The Co-Trustees prioritized a longer duration of O&M coverage for POETSs than for municipal water systems given the higher per-home annual cost of maintaining a POETS. After depletion of the Settlement, the costs for POETS O&M at homes with HI<1 (i.e., those without a health advisory from MDH), currently estimated at $1,000 per year, will be the responsibility of individual homeowners. The O&M costs for municipal water systems are spread across many homeowners and businesses. Any increase due to new treatment for PFAS will be far less than the annual cost for a POETS. In many cases, once the Settlement is depleted, homeowners with wells that do not have an MDH health advisory may not be able to afford the annual $1,000 cost for maintaining their POETS and, as a result, may stop using the POETS to treat their water. Providing a longer period of funding for POETSs O&M helps ensure treatment equity between private and municipal well users.

Table 9.15. Sample of annual O&M costs for POETSs, interest earnings, and fund balance.

Year	Fund balance, beginning of year	Annual O&M cost, with inflation	Annual interest on funds remaining after O&M expenses	Fund balance at end of year, after O&M cost and interest earnings
1	$28.00	$0.98	$0.95	$27.97
2	$27.97	$1.00	$0.94	$27.91
3	$27.91	$1.03	$0.94	$27.82
4	$27.82	$1.07	$0.94	$27.69
5	$27.69	$1.10	$0.93	$27.52
6	$27.52	$1.13	$0.92	$27.31
7	$27.31	$1.16	$0.92	$27.07
8	$27.07	$1.20	$0.91	$26.77
9	$26.77	$1.24	$0.89	$26.43
10	$26.43	$1.27	$0.88	$26.04

9.4 Summary of drinking water project costs

The $276 million for drinking water infrastructure capital and the $115 million for annual O&M are based on community-specific cost estimates. Details are provided earlier in this chapter, as well as in Appendix E, Section E.2. Table 9.16 provides a summary of estimated capital costs, annual O&M, and total Settlement costs for each community. Total Settlement costs consist of the estimated capital costs plus 20 years of estimated O&M for treatment on municipal water systems (where applicable), plus 30 years of estimated annual O&M for all POETSs within each community (where applicable). The estimated costs in Table 9.16 were used in the development of the Final Plan, but do not represent specific allocations for any one community. Instead, the Settlement will fund actual Settlement-eligible capital and O&M costs, as funds remain available. Figure 9.2 summarizes the locations of proposed projects for communities with municipal drinking water systems. Figure 9.2 does not show the locations of POETSs, but an interactive map on the 3M Settlement webpage includes the locations of all POETSs.

Table 9.16. Estimated capital, O&M and total Settlement costs by community.

Community	Major components	Capital costs for drinking water infrastructure ($ millions)*	Annual O&M for drinking water infrastructure ($ millions)**	Total Settlement costs ($ millions)+
Afton	POETSs only	$0.21	$0.05	$1.67
Cottage Grove	• Treat 8 of 12 existing public wells • Replace 2 existing public wells with 1 new public well that will receive treatment • Add 2 new water treatment plants • Connect 156 homes • Supply other private wells with POETSs if over threshold	$63.24	$1.45	$91.88
Denmark	POETSs only	$0.01	$0.004	$0.13
Grey Cloud Island	POETSs only	$0.12	$0.08	$2.24

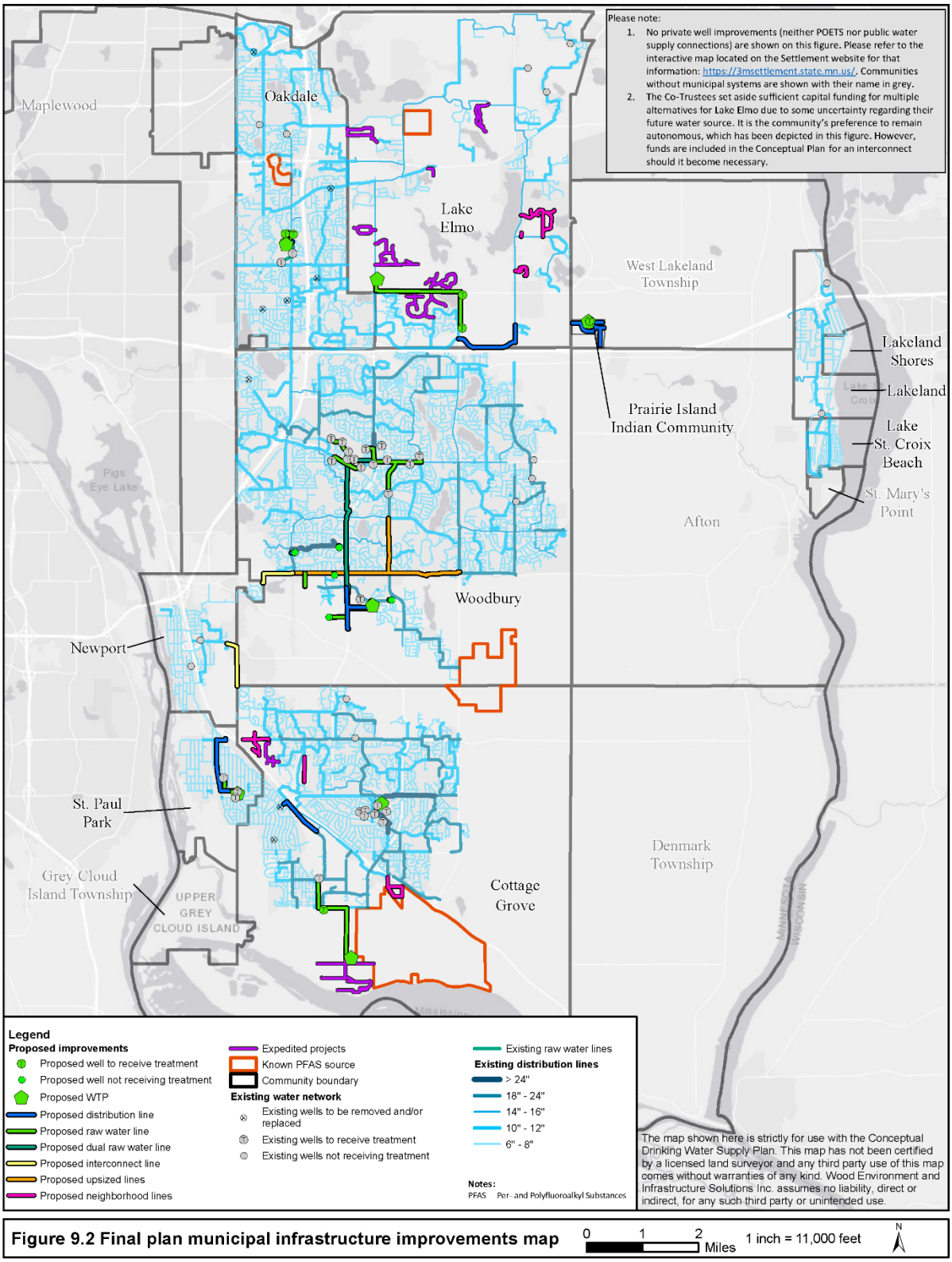
Community	Major components	Capital costs for drinking water infrastructure ($ millions)*	Annual O&M for drinking water infrastructure ($ millions)**	Total Settlement costs ($ millions)+
Lake Elmo	• Supply drinking water from a combination of existing wells and new wells or an interconnect with Woodbury • Connect 97 homes • Supply other private wells with POETSs if over threshold	$31.85	$0.43	$40.23
Lakeland, Lakeland Shores	• Connect 29 homes • Supply other private wells with POETSs if over threshold	$1.41	$0.001	$1.44
Maplewood	POETSs only	$0.02	$0.01	$0.30
Newport	• One interconnect with Woodbury and one with Cottage Grove • Connect 3 homes • Supply other private wells with POETSs if over threshold	$2.95	$0.01	$3.12
Oakdale	• Treat 2 of 9 existing public wells and expand 1 treatment plant • Replace 3 existing public wells with 3 new public wells that will receive treatment • Supply other private wells with POETSs if over threshold	$25.61	$0.79	$40.63
Prairie Island Indian Community	• Treat 1 existing public well • Add 1 new water treatment plant	$7.18	$0.14	$9.87
St. Paul Park	• Treat 3 of 3 public wells • Add 1 new water treatment plant • Connect 6 homes • Supply other private wells with POETSs if over threshold	$15.88	$0.42	$23.96
West Lakeland	POETSs only	$2.32	$0.66	$20.62
Woodbury	• Treat 15 of 19 existing wells • Replace 1 existing public well with 1 new public well • Add 1 new water treatment plant • Connect 5 homes • Supply other private wells with POETSs if over threshold	$125.15	$1.47	$153.31
	Total	$275.94	$5.49	$389.38

*Does not include pretreatment or inflation; see Section 9.1 for details.

**Includes annual O&M on treatment for municipal water systems and annual O&M for POETSs.

+ The total for capital ($275.94 million) plus 20 years of O&M on treatment for municipal water systems and 30 years of O&M for POETSs; the allocations for O&M are rounded up and total $115 million.

Figure 9.2. Summary map of the location and layout of proposed drinking water projects included in the Final Plan.



9.5 Contingency funds

The Co-Trustees have set aside $183 million in the Final Plan to fund several different areas of future uncertainty, if needed. Additional wells may need treatment in the future, either because of changes in contamination or because of changes in health guidance values. It is difficult to predict exactly how much future treatment may be required. In addition, two communities affected by PFAS may need alternative sources of water due to potential restrictions on use of aquifers that affect White Bear Lake. DNR is working with communities to resolve the White Bear Lake issue, but specific solutions will take time to identify, design and fully implement.

Despite these significant uncertainties, Co-Trustees had to determine a specific amount to set aside to fund potential future needs. Three potential sources of uncertainty were examined to help set the amount. In balancing among initial capital costs, long-term O&M costs, and other priorities, Co-Trustees concluded that $183 million is reasonable to fund future uncertainties.

The sections below provide details on the three potential sources of uncertainty that were analyzed to help determine the $183 million contingency amount. The total capital and O&M costs presented below exceed $183 million. It is unlikely that all of the needs described below will actually arise in the future.

If future needs turn out to be less than the estimates used for the contingency allocation, funds will be reallocated to other purposes (see Chapter 10). In the unlikely event that future needs exceed the contingency funding, the Settlement Agreement and Consent Order require 3M to fund the costs of treatment for any well with a health advisory (i.e., those wells with HI≥1).

9.5.1 Cost estimates for potential future treatment

The groundwater model was used to conduct a particle tracking analysis that provides an estimate of potential future plume movement. The particle tracking analysis identifies which wells might be affected by contamination in the future.

The particle tracking analysis does not estimate the future level of contamination or the future HI value for any wells. It identifies only wells that might be affected by PFAS in the future. In addition, new research on PFAS could result in decisions by MDH to reduce health guidance values (HBVs or HRLs), or to add new ones for additional types of PFAS chemicals. This may result in new wells requiring treatment because they meet the treatment threshold. (New research could also lead to MDH increasing HBVs or HRLs, which would result in less need for new treatment.) Costs were estimated for adding GAC treatment to every well that the particle tracking analysis suggests could become affected by PFAS in the future. The estimated capital cost to treat all these wells is $32.9 million. (See Table E.64, Appendix E.)

Recent information suggests that new growth-related wells planned by Woodbury may require treatment when they are built. Woodbury is planning up to five new wells to meet future growth. These wells will be located in the south well field near Well 19, where recent test results show that the HI is now above 0.5, suggesting that the new wells may require treatment as well. Treatment on these wells would be Settlement-eligible. The estimated capital cost for GAC treatment on these new wells is $25 million.

O&M cost estimates for potential future treatment

Any treatment implemented due to future contamination or changes in health guidance values will lead to new O&M costs. The annual O&M cost estimate for treatment for all the wells that are identified in the particle tracking analysis is $1.88 million. The annual treatment O&M for up to five new wells in

Woodbury's south wellfield is estimated at $0.81 million per year. These O&M cost estimates are for GAC treatment but do not include pretreatment. Assuming 3.5% interest and 3% inflation, the total cost for 20 years of O&M on potential new municipal well treatment, plus 30 years of O&M on potential new POETS, would be about $63 million.

9.5.2 Cost estimates for alternative drinking water sources

The contingency can be used to fund potential alternative water sources for PFAS-affected communities if it is determined that a change is needed to ensure compliance with the White Bear Lake court decision. In order to determine a funding amount for alternative water sources, the Co-Trustees estimated costs for Lake Elmo and Oakdale. Options for Oakdale include retaining their own groundwater wells or switching to SPRWS for their drinking water, either of which would fund their water needs through 2040. Lake Elmo is anticipated to need additional water supply in the future due to growth. Their options include: 1) installing two new wells within the City of Lake Elmo and adding treatment if necessary; 2) an interconnect with Woodbury supplied by three new wells that may require treatment for PFAS; 3) switching to SPRWS for all of its drinking water needs, or 4) using water from multi-benefit wells that may be implemented as part of groundwater remediation efforts (see Section 4.2.11; note that cost estimates for multi-benefit wells have not yet been developed).

If it becomes necessary for Oakdale and Lake Elmo to change their drinking water source from groundwater to SPRWS, there will be additional capital costs over and above the estimates shown in Table 9.5 and 9.9 above, as well as additional O&M costs. The additional capital costs for switching Lake Elmo and Oakdale to SPRWS amount to $4 million.

O&M cost estimates for the SPRWS option for Oakdale and Lake Elmo would be entirely from bulk water charges from SPRWS. As a result, the annual cost will grow over time as Oakdale and Lake Elmo grow and purchase more water from SPRWS (see Appendix E, Section E.4.5). Assuming 3.5% interest and 3% inflation, the total cost to fund O&M for 20 years is $72 million. The Settlement could fund some portion of annual bulk water charges from SPRWS, but the Co-Trustees have not yet determined exactly how much of the charges could be Settlement-eligible.

Co-Trustees recognize that Lake Elmo and Oakdale may consider other options within this cost estimate. This estimate is also sufficient to fund treatment if needed for the three new wells in Woodbury that would be necessary if Lake Elmo chooses to implement the interconnect option. Treatment would be implemented if the HI equals or exceeds the treatment threshold of 0.5.

9.6 Additional fund allocations

Two additional allocations are included in the Final Plan – drinking water protection and state administration.

The Co-Trustees set aside $70 million for drinking water protection (see Chapter 8 for a description of how these funds will be used). The amount comes from a preliminary estimate to improve groundwater quality in areas affected by PFAS. This allocation is intended to protect and improve the groundwater quality for future drinking water use for the entire region by reducing PFAS in the environment; actions may include reducing PFAS in groundwater using multi-benefit wells, targeted removal of PFAS-contaminated sediments, and/or the removal of PFAS from surface water.

The Co-Trustees set aside $15 million to fund state administration costs for implementing the plan. The state administration allocation will be used until the funds are depleted and that is estimated to extend

over the next 20 years. The amount is based on current state administration costs for staff and consultants, with the expectation that annual costs will decline in future years as projects are completed. This amount will also fund the investigation and feasibility study for Project 1007.

There were two fund allocations in the draft Recommended Options (see chapter 7) that are not included in the Final Plan. Based on feedback from communities and the work groups, the Co-Trustees concluded that while sustainability and conservation projects are an important part of Priority 1, they are of lower priority than other fund allocations. Feedback from communities resulting in substantial increases in capital costs, and the determination that additional contingency funds were needed to fund future uncertainties, contributed to removing funding for sustainability and conservation projects in the Final Plan.

The draft recommended options also included an allocation for costs for potential future neighborhood connections to municipal water systems. This allocation was intended to fund additional future entire neighborhood connections if new sampling data eventually showed a significant number of private wells impacted and that these connections would be cost-effective. Ultimately, this contingency was removed from the Final Plan in support of other funding priorities. However, the contingency for future treatment described above will be used to fund the costs to connect homes (if a water main is already available at the home), or provide POETSs, if the need arises in the future to ensure access to safe drinking water.

The Final Plan allocates $700 million from the Settlement to different categories presented in Chapter 8. Chapter 6 and Appendix E contain the cost estimates used as the starting point for the fund allocations in the draft recommended options and, ultimately, in the Final Plan. Based on input from the work groups, communities, and general public, the Co-Trustees made a series of decisions about the types of drinking water infrastructure costs that will be eligible for Settlement funding. Those decisions determined the amount of funding for capital and operations and maintenance (O&M) that is necessary from the Settlement.

10. Final Plan Implementation

This Final Plan will serve as a guide for using the Settlement to provide safe, sustainable drinking water to the affected communities in the East Metropolitan Area. This chapter describes the Co-Trustees' vision of how project design and implementation will proceed from initial steps to full implementation.

Section 10.1 discusses how funding will be administered for capital and operation and maintenance (O&M) expenses; Section 10.2 describes the Co-Trustees' process for funding drinking water protection projects; Section 10.3 describes how the Co-Trustees will use contingency funding; and Section 10.4 presents the Co-Trustees' annual review process and strategy for fund reallocation, should it be necessary.

10.1 Capital and O&M

The implementation of the Final Plan focuses on capital infrastructure for public water systems and private wells that currently meet or exceed an HI of 0.5. There are separate processes for implementing municipal infrastructure projects (described in Section 10.1.1) and POETSs for private wells (described in Section 10.1.2).

10.1.1 Municipal projects

Municipal capital and O&M projects will be driven by the communities. The Co-Trustees will follow a simple process that facilitates providing funding for capital costs to the communities for public water system planning, design, permitting, construction, and O&M (Figure 10.1). Communities will need to provide documentation to the Co-Trustees as a part of the grant process to ensure that projects and spending are consistent with the Final Plan and that rules and regulations are followed. This process is expected to include the following steps.

Figure 10.1. Grant process

Notes:

* Providing project information is each community's responsibility; other steps are largely the State's responsibility.

Internal MPCA administrative grant process and grant agreement are happening concurrently with grantee requesting bids from contractors (typically 30-day bidding process) for the construction phase.

First, communities will initiate the grant process with the state by providing detailed information to the Co-Trustees on specific projects. Requested information may include a detailed budget, the timing of the project, the technology (GAC or IX [if approved for use]), pretreatment and/or stormwater management needs, any conservation or sustainability aspects of the project, and/or other information. All communities must comply with federal, state, and local rules and regulations, and are responsible for evaluating all projects and ensuring that they do so. If a community is not confident that their plans will comply, the community will need to discuss appropriate grant funding with the Co-Trustees.

Next, the state will review the information provided by the communities in a timely manner, request clarification or additional information as needed, and resolve any questions about compliance with rules and regulations and cost eligibility with the community before entering into a grant agreement for the project. Grant agreements will require communities to provide progress and cost updates so the Co-Trustees can adaptively manage and track the Settlement funds, and report to the Legislature and the public on progress. Communities will likely have multiple grants over time for different phases of a given project (e.g., planning/design, construction, O&M).

After a grant agreement is in place, the community will then follow their own process to select a contractor. In addition, communities must follow state requirements for contracting and bidding (see Box). If appropriate, the state and community can amend the grant agreement to reflect cost differences in bids.

Contracting and Bidding Requirements

Per Minn. Stat. §471.345, grantees that are municipalities as defined in Subd. 1 must follow the law.

(a) For projects that include construction work of $25,000 or more, prevailing wage rules apply per Minn. Stat. §§177.41 through 177.44. These rules require that the wages of laborers and workers should be comparable to wages paid for similar work in the community as a whole.

The grantee must not contract with vendors who are suspended or debarred in MN: http://www.mmd.admin.state.mn.us/debarredreport.asp

Change-outs of media in municipal systems will be managed under grant agreements for O&M. Generally, change-outs will be based on monitoring of raw water quality, number of treatment vessels, post-filter testing, and performance of the filter media. Other factors that may be considered could include loading/pressure differences due to non-PFAS constituents (i.e. iron). Capacity will vary across the communities; as such the frequency of media change-outs may also vary. Some communities may need multiple change-outs per year, while others may only need a change-out after many years. MPCA, in consultation with MDH, will regularly review performance data to monitor when the treatment vessel media is approaching loading capacity and a change-out will be necessary (see Appendix F, Section F.6 for more information on media consumption). This process is consistent with monitoring activities currently in place for Oakdale, Cottage Grove, Saint Paul Park, and Woodbury. MPCA will coordinate with the communities to determine appropriate timing and plan for reimbursable change-outs.

10.1.2 Private wells

For private well owners, the MPCA will continue to manage the installation and maintenance of POETSs using contractors. During implementation of the Settlement, private wells will continue to be tested by the State of Minnesota for PFAS at no cost to the homeowners (see: https://www.pca.state.mn.us/waste/well-sampling-east-metro-area for more information). Homeowners can request that their well be added to the sampling program by using the Well Sampling Request form (available at https://survey.vovici.com/se/56206EE36F5EF3E5).

The standard schedule of media change-out of in private wells is once per year. This schedule could be adjusted as necessary depending on actual use and performance of the POETSs.

10.2 Drinking water protection

The Co-Trustees will also begin work on the drinking water protection portion of the Final Plan. The Co-Trustees are evaluating actions that would protect drinking water by reducing PFAS concentrations in groundwater or protecting areas from migration of PFAS in the groundwater. For example, the MPCA is currently evaluating PFAS impacts in soil, groundwater, surface water, sediments, and foam on surface water along the Project 1007/Raleigh Creek corridor and their impacts on drinking water (more information about Project 1007 can be found here: https://3msettlement.state.mn.us/project-1007). This information will inform potential projects to protect drinking water quality. The Co-Trustees will also continue to explore other types of drinking water protection projects such as targeted removals of PFAS-contaminated sediments or the removal of PFAS from surface water outside of the disposal areas. Using the results of the ongoing evaluations discussed above, the Co-Trustees will identify potential drinking water protection projects and apply this funding to actions that are likely to yield the most benefit.

10.3 Contingency

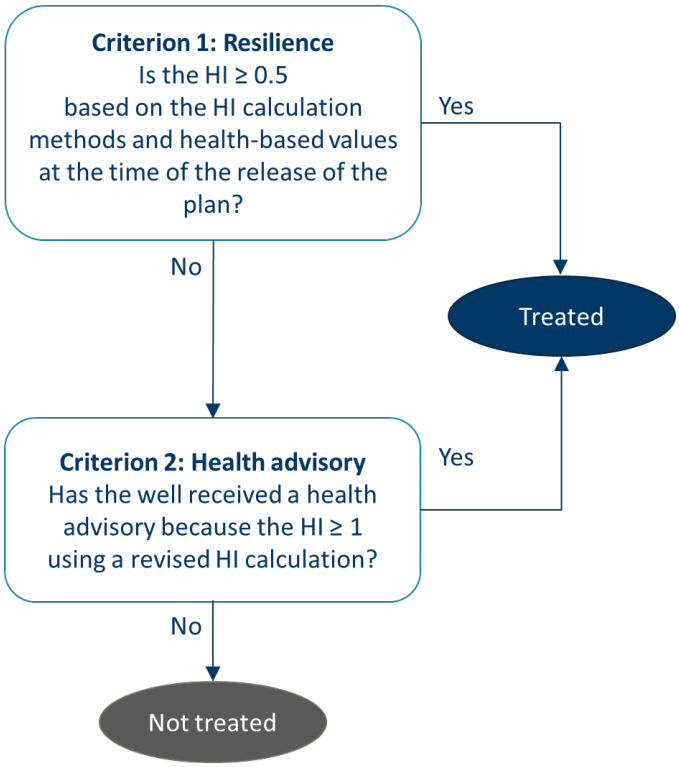
The $183 million contingency fund allocation may be used to fund several different areas of future uncertainty. These could include new wells that need treatment, or alternative sources of water for certain PFAS-affected East Metropolitan Area communities should it become necessary due to court-ordered restrictions on use of aquifers that affect White Bear Lake water levels. The Co-Trustees will determine what costs are eligible for funding by the contingency based on the eligible costs in the Final Plan and consistency with the framework of the Settlement and the Final Plan.

As discussed in Chapter 8, the Final Plan uses a treatment threshold of HI ≥ 0.5 to provide resiliency, helping to expedite addressing contamination and minimize costs of being reactive to changes in the future. Wells that currently have a HI between 0.5 and 1 (i.e., treated for resilience) or an HI ≥ 1 (i.e., have a health advisory) are both accounted for in the capital and O&M fund allocations. The HI calculation, methods, and MDH health-based guidance values used in the Final Plan are presented in Figure 8.2.

During the implementation of the plan, the contingency will be used to treat additional wells that exceed the treatment threshold of HI ≥ 0.5 using the HI calculation at the time of the release of the Final Plan (Figure 8.2), and wells that receive a new health advisory should the HI calculation change. These two criteria are explained in more detail below and illustrated in Figure 10.2:

1. **Criterion 1: Resilience.** Treatment will be provided for additional wells that exceed the treatment threshold using the HI calculation in Figure 8.2 because they are newly sampled, or measured concentrations have increased. This will maintain resilience against future change and uncertainty and provide equity; wells that have future PFAS concentrations that would have qualified them for treatment today would also qualify for contingency funding.
2. **Criterion 2: Health advisory.** Should the health-based guidance for PFAS change, the resulting recalculation of the HI could mean that additional wells receive a health advisory because they have an HI ≥ 1 using an updated HI calculation method and values. Treatment would be provided for any well that receives a health advisory.

Figure 10.2. Evaluating additional wells for treatment using the contingency fund allocation. For a new well to be treated using contingency funds, the measured concentrations in the well would need to result in an HI ≥ 0.5 using the HI calculation, methods, and MDH health-based guidance values used in the Final Plan (Criterion 1), or the well would need to have received a health advisory because the HI ≥ 1 using a revised HI calculation (Criterion 2).



10.4 Annual review and strategy for fund reallocation

As the Final Plan implementation progresses over the next two to three decades, the Co-Trustees anticipate that actual costs may differ from the initial amounts for each fund allocation (see Chapters 8 and 9).

The Co-Trustees will periodically reevaluate progress, review how actual costs compare to estimates, and monitor where and when funds may warrant reallocation. The Co-Trustees will at a minimum conduct an annual review of the Final Plan implementation efforts and obtain feedback from the work groups. This review will include consideration of new information that has evolved over the previous year, a review of actual costs of projects, reallocation discussions as needed, and discussion of any other adjustments that may be necessary to ensure the effectiveness of the plan. If significant topics arise for discussion between annual reviews, the Co-Trustees will also convene the work groups to seek input. All work group meetings will continue to be open to the public and the Co-trustees will continue to use the Minnesota 3M PFAS website (https://3msettlement.state.mn.us/) to update the public on project implementation.

The Final Plan provides a framework with flexibility to reallocate funding should it be necessary. The following sections explain the Co-Trustees' process for reallocation from each of the five funding priorities.

10.4.1 Capital costs for drinking water supply and treatment

The $317 million in the capital costs fund allocation is based on the estimated infrastructure and construction costs for each community as described in Section 9.2. However, as communities develop detailed designs and solicit bids for construction, costs may be higher or lower than expected. Any savings resulting from a capital project's actual expenses being less than estimated will first be used to fund other capital projects' Settlement-eligible expenses that are greater than the estimated cost. This reallocation could be used across different communities if needed. The majority of these projects will be planned and constructed in the next three to five years, at which point the Co-Trustees will be able to determine whether some funds can be used for other purposes with input from the work groups. Funding will not be reallocated to other uses until the majority of projects are completed, at which time the Co-Trustees will determine how to spend any excess funds with input from the work groups and public. Some funds will need to be held longer until projects that begin later are finalized.

10.4.2 Costs for O&M

The $115 million in the O&M fund allocation will be used for the operation and maintenance of drinking water supply treatment as long as funds are available. Any annual savings because the actual O&M for a system is less than estimated will be used to fund any other system's actual annual expenses that are greater than estimated. If all systems see a savings from the annual estimate, remaining funding would be used to pay for any future exceedances of estimates or to extend the number of years O&M is provided. Annual savings for all systems would be allocated between municipal and private wells in proportion to the initial funding allocation. Funding for O&M will not be reallocated to other uses.

10.4.3 Drinking water protection

The $70 million in the drinking water protection fund allocation will be used for projects to improve the quality of the groundwater as a drinking water source. Specific projects are to be determined in the near future. The Co-Trustees will know how much funding is needed for drinking water protection projects after the investigations and feasibility studies are complete, and projects are constructed. Until that time, funding will not be reallocated to other uses. If there are any funds that are not needed, the Co-Trustees will determine how to spend any remaining funds with input from the work groups and public.

10.4.4 Contingency

The $183 million contingency fund allocation may be used to fund several different areas of future uncertainty discussed in Section 8.2.4. Contingency funding will not be reallocated to other uses unless there is appropriate justification, such as a determination that an alternative source of water for Lake Elmo and Oakdale is not needed. If contingency funding becomes available for reallocation, the Co-Trustees will determine how to spend it with input from the working groups and public.

10.4.5 State administration

The $15 million state administration fund allocation will be used to fund administrative expenses including the Project 1007 assessment in Priority 1, contractor support, and staff and consultant expenses. Funding will remain in this allocation until it is depleted. If any funding is not needed, the Co-Trustees will determine how to spend it with input from the work groups and public.

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