Draft Environmental Impact Statement
on the
Hancock Pro Pork Feedlot Project, Stevens and Pope Counties

Minnesota Pollution Control Agency
Responsible Government Unit

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ABSTRACT: Hancock Pro Pork is a multisite hog feedlot project located in Stevens and Pope Counties. The project includes a hog farrowing and nursery site, which is jointly owned by the members of Hancock Pro Pork. This site produces feeder hogs, which are then distributed to the members either for feeding out to market weight at their own facilities or sale on the open market. An Environmental Assessment Worksheet (EAW) was prepared on this project in 1997, and the MPCA concluded the EAW process with a negative declaration (no Environmental Impact Statement (EIS) required). This decision was reversed in late 1998 by the Pope County District Court, which ordered the preparation of an EIS. This draft EIS addresses the potential for environmental and socioeconomic impacts from the farrowing and member sites. In particular, the potential for impacts on ground water, surface water, air, human health, wildlife, and habitat are assessed, as well as manure management practices, appropriate alternatives, and mitigation. The draft EIS is being made available for public review pursuant to Minn. R. 4410.2600, and will be on public review for 45 days, during which two public meetings will be conducted in the area of the project. Written comments on the draft EIS will be responded to in a written response document that will in turn be distributed to all on the mailing list. Any needed revisions will be incorporated into the final EIS, which will be publicly distributed and then brought to the MPCA Citizens Board for the adequacy decision. All on the mailing list will be notified in advance of the public meetings and the Board adequacy decision meeting.
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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPENDICES</td>
<td>...........................................................................................................</td>
<td>I</td>
</tr>
<tr>
<td>ACRONYM LIST</td>
<td>...........................................................................................................</td>
<td>I</td>
</tr>
<tr>
<td>GLOSSARY</td>
<td>...............................................................................................................</td>
<td>II</td>
</tr>
<tr>
<td>EXECUTIVE SUMMARY</td>
<td>...........................................................................................................</td>
<td>1</td>
</tr>
<tr>
<td>1.0 PROJECT OVERVIEW</td>
<td>...........................................................................................................</td>
<td>1</td>
</tr>
<tr>
<td>1.1.1 Chronology of Events</td>
<td>...........................................................................................................</td>
<td>2</td>
</tr>
<tr>
<td>1.1.2 Decision to Prepare EIS</td>
<td>...........................................................................................................</td>
<td>4</td>
</tr>
<tr>
<td>1.1.3 Cost Dispute</td>
<td>...........................................................................................................</td>
<td>5</td>
</tr>
<tr>
<td>1.2 SCOPE OF EIS</td>
<td>...........................................................................................................</td>
<td>6</td>
</tr>
<tr>
<td>1.3 DATA SOURCES USED FOR THE EIS</td>
<td>...........................................................................................................</td>
<td>7</td>
</tr>
<tr>
<td>1.4 OVERVIEW OF EIS</td>
<td>...........................................................................................................</td>
<td>9</td>
</tr>
<tr>
<td>2.0 PROJECT DESCRIPTION</td>
<td>...........................................................................................................</td>
<td>12</td>
</tr>
<tr>
<td>2.1 GENERAL PROJECT INFORMATION</td>
<td>...........................................................................................................</td>
<td>12</td>
</tr>
<tr>
<td>2.2 GENERAL PRACTICES</td>
<td>...........................................................................................................</td>
<td>14</td>
</tr>
<tr>
<td>2.2.1 Hog Feed and Additives for Farrowing and Finishing Sites</td>
<td>...........................................................................................................</td>
<td>14</td>
</tr>
<tr>
<td>2.2.2 Pit Additives</td>
<td>...........................................................................................................</td>
<td>14</td>
</tr>
<tr>
<td>2.2.3 Manure Application Practices</td>
<td>...........................................................................................................</td>
<td>15</td>
</tr>
<tr>
<td>2.2.4 Mortality Management</td>
<td>...........................................................................................................</td>
<td>16</td>
</tr>
<tr>
<td>2.3 SITE SPECIFIC PROJECT INFORMATION</td>
<td>...........................................................................................................</td>
<td>16</td>
</tr>
<tr>
<td>2.3.1 Farrowing Facility</td>
<td>...........................................................................................................</td>
<td>16</td>
</tr>
<tr>
<td>2.3.1.1 Pre Project Description</td>
<td>...........................................................................................................</td>
<td>16</td>
</tr>
<tr>
<td>2.3.1.2 Post-Project Description</td>
<td>...........................................................................................................</td>
<td>16</td>
</tr>
<tr>
<td>2.3.2 Alan Charles Feedlot</td>
<td>...........................................................................................................</td>
<td>18</td>
</tr>
<tr>
<td>2.3.2.1 Pre Project Description</td>
<td>...........................................................................................................</td>
<td>18</td>
</tr>
<tr>
<td>2.3.2.2 Post Project Description</td>
<td>...........................................................................................................</td>
<td>18</td>
</tr>
<tr>
<td>2.3.3 Gary Greiner Feedlot</td>
<td>...........................................................................................................</td>
<td>19</td>
</tr>
<tr>
<td>2.3.3.1 Pre Project Description</td>
<td>...........................................................................................................</td>
<td>19</td>
</tr>
<tr>
<td>2.3.3.2 Post Project Description</td>
<td>...........................................................................................................</td>
<td>19</td>
</tr>
<tr>
<td>2.3.4 Jon Nohl Feedlot</td>
<td>...........................................................................................................</td>
<td>20</td>
</tr>
<tr>
<td>2.3.4.1 Pre-Project Description</td>
<td>...........................................................................................................</td>
<td>20</td>
</tr>
<tr>
<td>2.3.4.2 Post-Project Description</td>
<td>...........................................................................................................</td>
<td>20</td>
</tr>
<tr>
<td>2.3.5 Mike Olson Feedlot</td>
<td>...........................................................................................................</td>
<td>21</td>
</tr>
<tr>
<td>2.3.5.1 Pre Project Description</td>
<td>...........................................................................................................</td>
<td>21</td>
</tr>
<tr>
<td>2.3.5.2 Post Project Description</td>
<td>...........................................................................................................</td>
<td>22</td>
</tr>
<tr>
<td>2.3.6 David Paul Feedlot</td>
<td>...........................................................................................................</td>
<td>22</td>
</tr>
<tr>
<td>2.3.6.1 Pre-Project Description</td>
<td>...........................................................................................................</td>
<td>23</td>
</tr>
<tr>
<td>2.3.6.2 Post-Project Description</td>
<td>...........................................................................................................</td>
<td>23</td>
</tr>
<tr>
<td>2.3.7 Stanley Schaefer Feedlot</td>
<td>...........................................................................................................</td>
<td>24</td>
</tr>
<tr>
<td>2.3.7.1 Pre-Project Description</td>
<td>...........................................................................................................</td>
<td>24</td>
</tr>
<tr>
<td>2.3.7.2 Post-Project Description</td>
<td>...........................................................................................................</td>
<td>24</td>
</tr>
<tr>
<td>2.3.8 Jere Solvie Feedlot</td>
<td>...........................................................................................................</td>
<td>25</td>
</tr>
<tr>
<td>2.3.8.1 Pre Project Description</td>
<td>...........................................................................................................</td>
<td>26</td>
</tr>
</tbody>
</table>
4.8.2 Negative Effects of Project .................................................................146
4.8.3 Effects Potentially Requiring Mitigation .................................147

5.0 MITIGATION MEASURES ........................................................................148

5.1 SITE SPECIFIC MITIGATION MEASURES ..............................................148
5.1.1 Farrowing Facility ............................................................................148
5.1.2 Charles ..............................................................................................149
5.1.3 Greiner ..............................................................................................149
5.1.4 Nohl ....................................................................................................150
5.1.5 Olson .................................................................................................150
5.1.6 Paul ....................................................................................................151
5.1.7 Schaefer .............................................................................................151
5.1.8 Solvie .................................................................................................152
5.1.9 Spohr .................................................................................................153
5.1.10 Zeltwanger .......................................................................................153

5.2 PENDING REGULATIONS THAT COULD EFFECT OPERATIONS OR COMPLIANCE ....154

5.3 MITIGATION MEASURES RECOMMENDED FOR CONSIDERATION .........154

6.0 MITIGATION ALTERNATIVES ..................................................................156

6.1 METHODS FOR MITIGATING PIT BARN EMISSIONS ...............................156
6.1.1 Biofilters .............................................................................................156
6.1.2 Non-Thermal Plasma ..........................................................................157
6.1.3 Aerobic Treatment .............................................................................157
6.1.4 Anaerobic Treatment ..........................................................................158
6.1.5 Easement ............................................................................................160
6.1.6 Variance .............................................................................................161
6.1.7 Right-of-Way Relocation ....................................................................161
6.1.8 Diet Manipulation ...............................................................................161
6.1.9 Manure Pit Additives ..........................................................................162
6.1.10 Oil Sprinkling ...................................................................................164
6.1.11 Reduction of Emitting Surfaces ..........................................................165
6.1.12 Temperature Control .........................................................................165
6.1.13 Shelterbelts/ Windbreak Walls ...........................................................165

6.2 MITIGATION OF OPERATIONAL ISSUES .............................................166
6.2.1 Mitigation of Threat to Ground water from Fall Application of Liquid Manure on Granular Soils ........................................................................166
6.2.2 Management of Animal Mortalities .....................................................166

6.3 MITIGATION OF SOCIAL AND ECONOMIC IMPACTS ..........................167

6.4 APPLICATION TO HANCOCK PRO PORK FACILITIES .......................168
6.4.1 Farrowing Facility ...............................................................................168
6.4.2 Alan Charles Finishing Facility ............................................................169
6.4.3 Gary Greiner Finishing Facility ............................................................169
6.4.4 John Nohl Finishing Facility .................................................................169
6.4.5 Mike Olson Finishing Facility ...............................................................169
6.4.6 David Paul Finishing Facility ...............................................................169
6.4.7 Stanley Schaefer Finishing Facility .......................................................169
6.4.8 Jere Solvie Finishing Facility ...............................................................170
6.4.9 Wayne Spohr Finishing Facility ............................................................170
# APPENDICES

<table>
<thead>
<tr>
<th>Appendix</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Feed and Additive Information</td>
</tr>
</tbody>
</table>
| B        | Current Permit Application for Farrowing Site and attachments  
          | Current Permits for the Schaefer Site and attachments |
| C        | Certificates of Compliance for Finishing Sites |
| D        | Minnesota Department of Natural Resources - Glenwood Office  
          | Correspondence  
          | National Heritage Nongame Resource Program Correspondence  
          | Minnesota Historical Preservation Society Correspondence |
| E        | Well Logs for HPP Project Sites |
| F        | Detailed Manure Management Review - MPCA - Detroit Lakes |
| G        | Compliance Inspection Report - MPCA - Detroit Lakes |
ACRONYM LIST

AMA - American Medical Association
bgs - below ground surface
BAH – Minnesota Board of Animal Health
BOD - Biological Oxygen Demand
BP – Before Present; used in geological time scale descriptions.
CDC - Centers for Disease Control
CFU – colony forming units; used to describe levels of fecal coliform bacteria in a water sample
CRWP - Chippewa River Watershed Project
CSAH - County State Aid Highway
CWI - County Well Index
DNR – Minnesota Department of natural Resources
EAW – Environmental Assessment Worksheet
EIS – Environmental Impact Statement
EPA - Environmental Protection Agency
EQB Environmental Quality Board
EU - European Union
FDA - Food and Drug Administration
GPS - Global Positioning Systems
HPP - Hancock Pro-Pork
HRL - Health Risk Limit
HVAC - Heating, ventilation, and air conditioning
iHRV - inhalation Health Risk Value
ISC - Industrial Source Complex
MDNR - Minnesota Department of Natural Resources (also DNR, MN DNR)
MDNR NHNRP - MDNR Natural Heritage and Nongame Research Program
MGS - Minnesota Geological Survey
MMP - Manure Management Plan
MN DNR – Minnesota Department of Natural Resources (also DNR, MDNR)
MPCA - Minnesota Pollution Control Agency
MPP - Minnesota Pork Producers
MSDS - Material Safety Data Sheet
NCH - North Central Hardwood Forest (Ecoregion)
NGP - Northern Glaciated Plains (Ecoregion)
NPDES - National Pollutant Discharge Elimination System
NRMRL - National Risk Management Research Laboratory
PM - Particulate Matter
PPR - Prairie Pothole Regions
SDC - State Demographic Center
TI - Tile Inlet
TPR - Tallgrass Prairie Region
TSS – total suspended solids
tVOOCs - Total Volatile Odorous Organic Compounds
UWN – Unique Well Number
GLOSSARY


**Acute iHRV**: The concentration of a pollutant in air below which immediate health effects on humans will probably not occur.

**Aerobic**: Occurring in the presence of molecular oxygen (said of chemical or biochemical processes such as aerobic decomposition).

**Agronomic rates**: The calculated rate of manure application based on the nutrient needs of the next crop, the amount of nutrients available in the manure and the amount of nutrients present in the soil.

**Algal bloom**: A proliferation of living algae in lakes, streams or ponds. Algal blooms are stimulated by enrichments of phosphates or other nutrients.

**Ammonia**: The gas (chemical formula: \( \text{NH}_3 \)) released by the microbiological decay of plant and animal proteins. Loss of ammonia to the atmosphere is commonly referred to as “ammonia volatilization”.

**Ammoniacal**: Of or pertaining to ammonia, or possessing its properties; as, an ammoniacal salt; ammoniacal gas.

**Ammonium**: the positively charged ionic form of ammonia.

**Amphibolite facies**: Rocks produced by medium- to high-grade regional metamorphism.

**Anaerobic digestion**: The breakdown with no oxygen available into simpler or more biologically stable compounds or both. Organic matter may be decomposed to soluble organic
acids or alcohols and then to gases such as methane and carbon dioxide. Bacterial action alone cannot complete destruction of organic solid materials.

**Animal composting**: The process of placing carcasses in layers with a carbon source and manure to allow the natural decomposition process to break down the carcass and stabilize its mass.

**Animal unit (AU)**: Taken from Minn. R. 7020.0300 subp. 5: “Animal Unit” means a unit of measure used to compare differences in the production of animal manure that employs as a standard the amount of manure produced on a regular basis by a slaughter steer or heifer for an animal feedlot or a manure storage area, calculated by multiplying the number of animals of each type in items A to I by the respective multiplication factor and summing the resulting values for the total number of animal units. For the purposes of this chapter, the following multiplication factor shall apply:

A. dairy cattle:

1. One mature cow (whether milked or dry):
   - (a) over 1000 pounds, 1.4 animal unit; or
   - (b) under 1000 pounds, 1.0 animal unit;

B. beef cattle:

1. one slaughter steer or stock cow, 1.0 animal unit;
2. one feeder cattle (stocker or backgrounding) or heifer, 0.7 animal unit;
3. one cow and calf pair, 1.2 animal units; and
4. one calf, 0.2 animal unit;

C. one head of swine:

1. over 300 pounds, 0.4 animal unit;
2. between 55 pounds and 300 pounds, 0.3 animal unit; and
3. under 55 pounds, 0.05 animal unit;

D. one horse, 1.0 animal unit;
E. one sheep or lamb, 0.1 animal unit;

F. chickens:

(1) one laying hen or broiler, if the facility has a liquid manure system, 0.003 animal unit; or

(2) one chicken if the facility has a dry manure system:

(a) over five pounds, 0.005 animal unit; or

(b) under five pounds, 0.003 animal unit;

G. one turkey:

(1) over five pounds, 0.018 animal unit; or

(2) under five pounds, 0.005 animal unit;

H. one duck, 0.01 animal unit; and

I. for animals not listed in items A to H, the number of animal units is the average weight of the animal in pounds divided by 1000 pounds.

**Aquifers**: Stratum or zone below the ground surface capable of storing water.

**Artesian aquifer**: An aquifer that contains ground water that is under sufficient pressure to rise above the level at which it is encountered by a well, but which does not necessarily rise to or above the ground surface.

**Bioaccumulate**: To accumulate in a biological system. This term is commonly used to describe the uptake over time of toxic substances that persist in biological systems. If the input of a toxic substance to an organism is greater than the rate at which the substance is lost from the organism, that substance is said to be bio-accumulating.

**Bioaerosols**: A cloud of biologically active particles that may exhibit infectivity, allergenicity, toxicity, or other adverse health effects.

**Biofilters**: A filter able to remove biological matter from gases passing through it.

**Biological oxygen demand (BOD)**: The quantity of oxygen used in the biochemical oxidation of organic matter in a specified time, at a specified temperature, and under specified conditions. A standard test used in assessing wastewater pollution strength.
**Broadcasting:** Method of applying manure on agricultural fields. Typically followed by disk or incorporation.

**Buffer zone:** Area of agricultural field in which solid or liquid manure application is prohibited.

**Calcareous:** Containing calcium carbonate.

**CALPUFF:** A non-steady-state computer modeling system being used for a wide variety of air quality modeling studies. This model was used in this EIS to assess air emission impacts from the feedlot sites.

**Chlorophyll-a:** The chemical in plants that captures the sun’s energy and uses that energy to make food, usually carbohydrates. The volume of chlorophyll-a is measured in a water sample and is used as an estimate of the amount of algae in water.

**Chronic iHRV:** The level of an airborne contaminant below which chronic (ie, long-term) health symptoms or disease in humans will probably not occur.

**Clastic strata:** Subsurface rock layer that consists of sediment composed mainly of fragments of rocks and minerals that have been transported from their place of origin.

**Clay basin:** (See earthen storage basin)

**Cohesive soils:** Soils whose particles adhere to one another, forming a ball when squeezed in a moistened state; generally said of clay soils; typically having relatively low permeability to water movement. See also granular soil.

**Coliforms:** bacteria related to *Escherichia coli* that inhabit the gut of animals.

**Cretaceous:** A geologic time period thought to have covered the span of time between 135 and 65 million years ago. This term is also used to describe a system of rocks that were formed during that time period.

**Crop available (or plant available) nitrogen:** Nitrogen in fertilizer that is actually usable by plants. May originate in fertilizer, legumes grown the last two years, or nutrients present in the soil.

**Delegated county:** Taken from Minn. R. 7020.0300 subp. A: A county that has applied for and received authorization pursuant to Minn. R. 7020.1600, subp.3a, item C to implement an animal feedlot program.

**Denitrification:** The transformation of oxidized forms of nitrogen (such as nitrate ion) to nitrogen gas.
**Devonian**: The name of a geologic time period thought to have covered the span of time between 400 and 345 million years ago. The term is also used to describe a system of rocks that were formed during that time period.

**Die-off rate**: The calculated average rate at which specific pathogens die and no longer remain viable.

**Earthen storage basin** (clay basin): A basin, typically lined with clay, a synthetic material, or a combination, in which manure is stored. The structure is not designed for treatment, only storage.

**Ecoregions**: Areas of relative homogeneity that are described based on mapped information based in turn on land use, soils, land and surface forms, and potential natural vegetation.

**Endocrine disruptor**: An exogenous (originating outside the body) agent that interferes with the synthesis, secretion, transport, binding, action, or elimination of natural hormones in the body that are responsible for the maintenance of homeostasis, reproduction, development, and/or behavior. (Synonym: environmental hormones, estrogen mimics)

**Endotoxin**: A portion of the outer wall of a gram-negative bacteria that can cause respiratory infections or allergic reactions.

**Eutrophication**: Aging of lakes, whereby aquatic plants increase in abundance and waters become deficient in oxygen. The process is usually accelerated by enrichment of water with surface runoff containing nitrogen, phosphorus and other pollutants.

**Farrowing**: Process of birthing pigs

**Fecal coliforms** (fecal bacteria): A subgroup of total coliform bacteria. Fecal coliforms are bacteria that live only in the intestines of warm-blooded animals. Fecal coliforms are used as indicators of the presence of other manure-borne pathogens in surface water and ground water.

**Finisher**: Hogs that are almost to market weight, typically considered 150 lbs. to 250 lbs.

**Gastroenteritis**: Inflammation of the stomach and intestines, caused by *Salmonella enteritidis*.

**Glacial outwash**: Sand and gravel deposited by meltwater streams at the front of an active glacier. Parent material for granular soils.

**Glacial till (or drift)**: Unstratified earthen material deposited directly by a glacier without reworking by meltwater; may consist of a mixture of clay, silt, sand gravel, and boulders ranging widely in size. For EIS purposes, glacial till is generally regarded as relatively resistant to large scale water movement, as opposed to glacial outwash, which is not.
Gneisses: A foliated rock formed by regional metamorphism, in which bands of granular minerals alternate with bands of flaky or elongate minerals. It is typically feldspar and quartz rich.

Granular soil: Soil that is sandy or gravelly rather than clayey, characterized by relatively high permeability to water movement. See also cohesive soil.

Granulite facies: Metamorphic rock unit that is typical of deep seated, high heat, regional metamorphism.

Grower: Hogs that are no longer considered nursery hogs (over 55 lbs.) but have not reached finishing weight (150 lbs).

Half-life: The length of time it takes for half an original population of microbes to die.

Health risk Limit: Concentration levels of compounds defined by the Minnesota Department of Health above which human health may be adversely affected.

Hormones: Natural, secretory products of endocrine glands (ductless glands that discharge directly into the bloodstream) that travel in the blood in very small concentrations and bind to specific cell sites called receptors in distant target tissues and organs, where they exert their effects on development, growth, and reproduction in addition to other bodily functions.

Hydrogeologic Units: See aquifers.

Impervious pad: A surface that is resistant to water movement, typically compacted soil, compacted clay, plastic or concrete. Used to protect ground water from contamination by materials stored on the surface of the earth.

Incorporation (immediate): The tilling of the soil after the broadcasting of manure to move the manure from the surface of the soil to under the soil surface. “Immediate” incorporation usually means tilling within 24-48 hours of manure spreading.

Injection: The application of manure beneath the soil surface.

Isopleth: Line representing a singular value of a compound concentration in the air.

Leaching: The removal of soluble materials, such as nitrates or chlorides, from soils or other material via water movement.

Mafic: Describes igneous rock that contains dark, iron and magnesium rich minerals.
Mesic prairie: Moderately moist prairie grassland.

Methemoglobinemia: Also called "Blue Baby" Syndrome. Nitrates consumed are converted to nitrite. The nitrites reach the bloodstream and begin oxidizing the iron in hemoglobin (oxygen carrying compound). This produces methemoglobin. Methemoglobin does not have oxygen carrying ability. Typically, enzymes present within the bloodstream convert the methemoglobin back to hemoglobin and no side effects occur. However, infants do not produce enough of the enzyme and, as methemoglobin is produced in greater quantities, oxygen availability to the cells is reduced and the baby can become ill and may die if not treated.

Moraine: A mound or ridge of unstratified glacial drift till, deposited by direct action of glacier ice.

Mutagens: A natural or human-made agent (physical or chemical) that can alter the structure or sequence of DNA.

Nitrate (NO$_3^-$): The nitrogen component of the final decomposition product of the organic nitrogen compounds. Nitrate is extremely water-soluble and its negative charge prevents its adsorption onto soil particles. This characteristic renders it highly susceptible to leaching. Nitrate moves readily through the soil with water movement, and is readily available to plants.

Nitrite (NO$_2^-$): Nitrite is an intermediate product in the conversion of ammonium to nitrate. Nitrite is extremely unstable in the presence of oxygen (nearly immediately converting to nitrate) and therefore is rarely detected in ground water.

Nitrogen cycle: The succession of biochemical reactions that nitrogen undergoes as it is converted to organic or available nitrogen from the elemental form. Organic nitrogen in waste is reduced by bacteria into ammonia (NH$_3$). If oxygen is present, ammonia is bacterially oxidized, first into nitrite (NO$_2^-$) and then into nitrate (NO$_3^-$). If oxygen is not present, nitrate and nitrite are bacterially reduced to nitrogen gas, completing the cycle.

Nitrification: The transformation of nitrogen or reduced nitrogen compounds to oxidized forms of nitrogen (such as nitrate ion).

Nutrients: Elements or compounds essential as raw material for organism growth and development. For plant growth, seventeen elements have been found to be universally essential, three mostly from air and water (carbon, hydrogen, oxygen) and fourteen from soil solids (nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, boron, molybdenum, copper, zinc, chlorine, and cobalt)(Brady, 1984). Six of the fourteen (nitrogen, phosphorus, potassium, calcium, magnesium, and sulfur) are used in relatively large amounts by plants and so called macronutrients. The other eight, even though as essential as the macronutrients, are required in much smaller quantities, and thus are called micronutrients.
**Overland flow:** A sheet or rivulets of water that flow over land rather than infiltrating. This occurs when the precipitation rate exceeds the infiltration rate of the ground's surface.

**Organic nitrogen:** nitrogen combined in organic molecules such as amines and amino acids. Urea is an example.

**Oxidation/reduction (redox) reactions:** Reactions that involve a change in the oxidation state of the atoms or ions involved. This change in oxidation state is due to the "loss" or "gain" of electrons. The loss of electrons from an atom produces a positive oxidation state, while the gain of electrons results in a negative oxidation state. Typically, chemicals that are oxidized are combined with oxygen; chemicals that are reduced, lose oxygen.

**Pathogens:** Agents that cause disease in humans, animals, or plants. There are numerous types, including but not limited to bacteria, fungi, viruses, and parasites.

**PCRAMMET:** A meteorological preprocessing computer program used to convert National Weather Service data for use in air dispersion models.

**Perimeter tile drains:** Drains that surround manure pits to lower the water table and reduce ground water pressure on the pit walls.

**Phosphorus:** One of the primary nutrients required for the growth of plants. Phosphorus is often a limiting nutrient for the growth of aquatic plants or algae in lakes and rivers.

**Phytoestrogens:** A group of naturally occurring chemicals derived from plants, having structure similar to estrogen and forming part of animal and human diets. Plant hormones are similar to but weaker than human estrogens

**Pit additive:** Chemical or natural compounds added to manure storage areas in efforts to reduce odor, break down solids, and to minimize clogging in land application equipment.

**Pleistocene:** The name of the subdivision of geologic time within the Quaternary Period spanning between two million years ago to approximately 8,000 years ago. It also describes sedimentary rocks and other geologic deposits during that time.

**Prairie Pothole Region (PPR):** An ecoregion extending from North Dakota into South Dakota and Minnesota, characterized by grasslands and wetlands concentrated around glacial "potholes" or depressions left in the landscape from glacial movement.

**Precambrian:** All geologic time and rocks formed during the time prior to 570 million years before present (BP).

**Premix:** Hog food supplement typically containing additional nutrients and vitamins for hog health and growth.
**Quaternary**: The name of a subdivision of a geologic era that began 2-3 million years ago and extends to the present, and rocks and deposits formed during that time.

**Regolith**: Fragmented and unconsolidated rock material that forms the surface of the land and overlies the bedrock. It includes rock debris, volcanic ash, glacial drift, alluvium, loess, and soil.

**Schists**: Strongly foliated rock formed by dynamic metamorphism that has well developed parallelism.

**Scrape and haul**: Method of removing and applying solid manure to agricultural fields. Typically used in small operations that house animals on concrete floors, and performed daily or every several days.

**Slatted floors**: Floor in a facility that has open spaces to allow manure and other waste material to pass through.

**Sub-basin**: Division of a larger watershed basin.

**Subtherapeutic use**: The practice of using pharmaceuticals to prevent or decrease the incidence of bacterial diseases and to increase weight gain in food-producing animals.

**Surface tile intake**: (see Tile Inlet)

**Surficial aquifer**: Water-bearing geologic unit that is close to the ground surface.

**Tallgrass Prairie Region**: Ecosystem defined by formerly dominant tallgrass species such as big bluestem. Now largely agricultural, with only remnants of the original vegetation remaining.

**Tile inlet**: Structure that connects the tile line to the surface so ponded water can be drained from a field.

**Tile Line(s)**: Structure(s) that carries water from agricultural fields through a series of connections to either a field that needs to be irrigated or to a surface water. Extensive installation of tile lines can convert wetlands into farmable fields.

**Turbid**: Water that is cloudy or opaque due to having sediment or foreign particles stirred up or suspended in it.

**Unique Well Number**: A number assigned to individual wells by the state Health Department.

**Undifferentiated**: Geological material formed from a common source and not sorted by weathering or other geophysical forces.
**Vertical gradient**: The rate of change of head pressure per unit of flow distance at a given point in the vertical direction.

**Watershed**: A region or area draining into a particular river, stream, or other body of water.

**Weathering-residuum**: Accumulation of decomposed rock debris remaining in place after all but the least soluble constituents have been removed.

**Zeolites**: A generic term for a large group of rocks that contain aluminum and silica in differing percentages. They are characterized by their easy and reversible loss of water of hydration and by their ready fusion and swelling when strongly heated.

**Zoonoses**: Diseases that have the ability to be transmitted between animals and humans.

**Zooplankton**: Aquatic microorganisms, sometimes counted in water samples to determine surface water clarity.
EXECUTIVE SUMMARY

Introduction
A draft Environmental Impact Statement (EIS) has been prepared on the Hancock Pro Pork feedlot project in Stevens and Pope Counties. Preparation of this EIS was ordered by the Pope County District Court.

Hancock Pro Pork, Inc. is a group of feedlot operators in the vicinity of Hancock, MN who individually own hog finishing facilities and who have joined together to build and operate a farrowing/nursery facility to supply their finishing facilities with feeder hogs. The group also includes two individuals who own no facilities for feeding hogs and sell their shares of feeder hogs on the open market.

The Hancock Pro-Pork (HPP) Project is a multi-site hog farrow-to-finish feedlot project consisting of one farrowing/nursery facility (five total confinement barns) located in Stevens County that is jointly owned by the Hancock group, and nine finishing facilities individually owned by HPP members and located in Stevens and Pope Counties. Six of the HPP members built new deep pit barns to accommodate their HPP feeder hogs. One of these latter members at one time proposed to add a third barn to the two he built initially, but has now stated that he does not intend to do so. Two other members utilize older, scrape-and-haul barns as their primary facilities for housing HPP hogs. Finally, one member initially planned to build a new barn, but has not yet done so, and has now stated that he may not do so, and may in fact leave the Hancock group. He currently feeds his shares of hogs at custom feeders in various locations.

The issues addressed in the EIS include the following:

- Impacts of the project on ground water and surface water;
- Impacts of the project on wildlife and wildlife habitat;
- Assessment of the air emissions and odors anticipated from the project; and
- Potential impacts associated with the proposed manure management practices.

Project Overview
The project initially consisted of the farrowing/nursery facility, fourteen existing or proposed finishing sites, and one member who planned on buying hogs and subsequently selling them on the open market for finishing. This configuration of the project was the subject of an Environmental Assessment Worksheet (EAW) in 1997. The project was subsequently modified, with some members withdrawing from the project, to the current project of the farrowing/nursery...
site, nine existing or proposed finishing sites, and two members who will sell hogs on the open
market for subsequent finishing.

The EAW process ended with a determination by the Minnesota Pollution Control Agency
(MPCA) that no EIS was required. This decision was reversed by the Pope County District
Court, which ordered the preparation of an EIS.

The project is completely built with the exception of the two barns proposed by two of the
group’s shareholders (see above). These proposed new barns are discussed in greater detail
below. The current configuration of the project was constructed after the EAW and prior to the
court order that an EIS be completed. An EIS is required on the entire project--the farrowing
facility and all nine finishing facilities associated with the project--because the project was
proposed at a time when the Environmental Quality Board (EQB) connected action rule applied
to animal agriculture projects. Under the rules, projects are connected actions and must be
assessed as a single project if: (a) one project would directly induce the other, (b) one project is a
prerequisite for the other, or (c) neither project is justified by itself.

The connected actions rule still exists in the EQB rules, but subsequent modification of the EQB
rules in October 1999 eliminated the rule’s applicability to animal feedlots. Nonetheless, this
EIS assesses the individual and cumulative effects of the project in accordance with the
connected action rule in place at the time of the project application and construction, and as
ordered by the court.

The Minnesota feedlot rules (Minn. R. ch. 7020) were revised after the farrowing and finishing
sites submitted permit applications to Stevens County and the MPCA. The new rules changed
the animal unit (AU) calculations for hogs being finished at the finishing sites. The old AU
calculation assigned an AU factor of 0.4 for each hog between 55 and 300 pounds. The new AU
factor for this weight of hog is 0.3 (meaning, for example, that a 1000-hog finishing barn has a
300 AU capacity). The new AU factor has been applied to the HPP project hog numbers for
consistency.

The project components evaluated for this EIS are: farrowing/nursery site (5 new barns – 1393.6
Animal Units (AU); Alan Charles (1 new barn – 300 AU; not yet built); Gary and Darby Greiner
(1 new barn – 300 AU); Jon Nohl (2 new barns – 600 AU); Mike Olson (older barns, no new
construction – 68 AU); David Paul (1 new barn – 300 AU); Stanley Schaefer (3 new barns, one
not yet built – 900 AU); Jere Solvie (1 new barn – 300 AU); Wayne Spohr (1 new barn – 300
AU plus 165 HPP AU in two older barns); John Zeltwanger (older barns, no new construction –
180 AU). The project also includes two members (Chad Solvie and Craig Swenson) who have
no facilities and sell their shares of HPP hogs on the open market.

Apr 03 Hancock Pro-Pork EIS Page ES-2•
The current HPP-related capacity for the project (assuming the Charles barn and the third Schaefer barn are not constructed) is 4206.6 AU. If those barns are both built (which is not their currently stated intention), the total would be 4806.6 AU.

It should be noted that animal unit totals at feedlots can vary over time depending on market conditions, operator decisions, and other factors, and they may be limited by applicable rule and permit provisions. The above figures were accurate at the time of site data gathering and compilation for this EIS.

**Hancock Pro Pork Farrowing Facility**

The farrowing facility site is located in Section 34, T123N, R41W, Moore Township, in Stevens County, Minnesota.

The farrowing facility consists of five total confinement barns (one farrowing, one nursery, three gestation), built in 1998, with slatted floors that drain into concrete pits of various depths beneath the barns. The farrowing facility houses a total of 8000 piglets, 2424 sows, and 60 boars. The total Animal Unit (AU) capacity for the site is 1393.6. The shallow concrete pit beneath the farrowing barn drains by gravity to the three gestation barn pits through connecting piping. The manure management plan (MMP) for the farrowing/nursery facility provides that manure is pumped and land applied during the spring and fall of every year. Fall application is the norm, but spring application is required if manure is applied on granular soils, in order to maximize nutrient uptake by crops and minimize loss of nitrate to ground water. Full capacity of the concrete underbarn storage pits is approximately 4.2 million gallons. Land available for land spreading is approximately 1560.7 acres.

**Alan Charles Feedlot**

Charles has proposed construction and operation of a feedlot facility in Section 4, T123N, R41W, Moore Township, in Stevens County, Minnesota.

One barn was initially proposed for the Charles project site. Charles has recently withdrawn his permit application and notified the MPCA that his plans have changed and he currently does not intend to build this barn. Nevertheless, this EIS includes this barn in the analysis in case Charles changes his mind again later on. As proposed, the barn would be built south of the house (only intermittently occupied) and shed that currently occupy the site (this is not the Charles home site). If built, the new barn would have slatted floors that drain into an 8-foot concrete pit under the barn, and would house 500 grower and 500 feeder hogs, for a total of 300 AU. The pit would be pumped annually and the liquid manure land applied on the approximately 1183 acres of fields available to Charles. Manure storage capacity would be approximately 435,000 gallons.
Gary Greiner Feedlot
The Greiner site is located in Section 2, T123N, R40W, Hoff Township, in Pope County, Minnesota.

One total confinement barn was constructed in October 1997 by the Greiners to house HPP hogs. This barn has slatted floors over an 8-foot concrete pit. The barn houses 1000 grower and feeder hogs for an AU total of 300 for the site. The pit is emptied and pumped once a year and the liquid manure is applied to approximately 448 acres. Manure storage capacity is approximately 435,000 gallons.

Jon Nohl Feedlot
The Nohl site is located in Section 24, T123N, R42W, Moore Township, in Stevens County, Minnesota.

Nohl has built two new total confinement barns on his home place to house HPP hogs. The north barn was built in 1997 with slatted floors over an 8-foot deep concrete storage pit. The south barn was built in 1998 with slatted floors over an 8-foot concrete storage pit (41x204 feet). Each barn houses 500 grower/feeder hogs and 500 finishing hogs for an AU total of 600 for the site. Each barn has a maximum manure capacity of 426,500 gallons each, for a site maximum manure storage capacity of 853,000 gallons. The liquid manure from the two barns is land applied on approximately 1,032 acres.

Mike Olson Feedlot
The Olson site is located in Section 26, T123N, R42W, Moore Township, in Stevens County, Minnesota.

No new construction was performed on this site, which employs older, existing facilities to house the HPP hogs. Two of the three existing barns currently house an average of 180-230 finishing hogs. The remaining barn on the site will not be used for livestock. The total AU capacity for the site is approximately 68. The open lots and barns are scraped and cleaned as needed, which currently is approximately every three days. The manure is hauled in a 180-bushel manure spreader, at a rate of approximately 415 to 480 cubic yards per year, and spread in solid form on the approximately 200 acres.

David Paul Feedlot
The Paul site is located in Section 14, T123N, R42W, Horton Township, in Stevens County, Minnesota.
The total confinement barn with concrete underbarn pit and a house were built on a virgin site in 1998. The barn currently houses 500 grower/feeder hogs and 500 finishing hogs for an AU total of 300 for the site. Maximum manure storage capacity for the site is approximately 435,000 gallons. Acreage for land application totals approximately 630 acres.

**Stanley Schaefer Feedlot**
The Schaefer site is located in Section 21, T123N, R41W, Moore Township, in Stevens County, Minnesota.

Schaefer built two new total confinement barns with concrete underbarn pits to house HPP hogs in 1998. Schaefer subsequently informed Stevens County that he was considering building a third barn having the same dimensions and physical characteristics as the two barns built in 1998, but he has more recently reconsidered, and this barn may never be built. This EIS considers both scenarios, in case he decides in the future to move forward with the third barn. The two built barns currently house a total of 1000 grower/feeder hogs and 1000 finishing hogs (600 AU). There are also two older barns on the site that intermittently house culls and slow growers. Maximum manure storage capacity for the site (including the proposed third new barn) is approximately 1.3 million gallons. Acreage for land application totals approximately 1,345 acres.

**Jere Solvie Feedlot**
The Solvie site is located in Section 5, T124N, R40W, Walden Township, in Pope County, Minnesota.

This site contains a mixture of barn types, including relatively new total confinement buildings (not all of which house HPP hogs) as well as buildings dating to the middle of the last century. A new total confinement barn was built in 1998 with an 8-foot deep concrete underbarn storage pit, and houses 1000 HPP hogs. An older total confinement barn that drains to an outdoor earthen basin was built in 1994 and houses approximately 750 non-Hancock hogs. The barns house a total of 1750 grower/feeder hogs and finishing hogs. Other, older barns on the site sometimes contain hogs from other suppliers, which are not the subject of this EIS. The total HPP AU for the site is 300, and the total for the site taken together is 525. Only manure from the non-Hancock total confinement barn drains to the earthen storage basin. The earthen basin and concrete pit are emptied once a year and the contents land applied. Maximum manure storage capacity for the site is approximately 1.45 million gallons. Acreage for land application of manure is approximately 1040 acres.
Wayne Spohr Feedlot
The Spohr site is located in Section 36, T123N, R42W, Horton Township, in Stevens County, Minnesota.

A pre-existing manure storage basin on this site was closed some time ago, and a new 300-AU total confinement barn with an 8-foot concrete underbarn pit was built in the excavated area in 1998. Currently, the site only accepts hogs from HPP. The total AU capacity for the site is 477, and this total includes some chickens and horses kept at the facility. Manure storage capacity for the site is approximately 477,190 gallons, which includes the new deep pit as well as a shallow pit under an older confinement barn. The concrete pit is pumped once a year and the liquid manure is land spread on portions of the available 1000 acres of fields.

John Zeltwanger Feedlot
The Zeltwanger site is located in Section 1, T123N, R41W, Moore Township in Stevens County, Minnesota.

No construction was performed on this site for the HPP project. Only existing buildings are used. Two of the three barns currently house a total of 600 finishing hogs. The remaining barn and attached lean-to are reportedly empty and are intermittently used to house hogs culled from the primary barns. The total AU capacity for the site is 180. The barns are scraped and cleaned as needed, which is approximately once per week. Approximately 692 acres are available for manure land application.

Findings
The EIS analysis has identified conditions at four facilities that require an assessment of mitigation measures or modifications to operating practices. The four sites that require consideration of mitigation are the farrowing/nursery site, and the Schaefer, Nohl and Solvie finishing sites.

The farrowing/nursery site and the Schaefer finishing site require a review of mitigation and/or monitoring to address modeled violations of air quality standards at their compliance boundaries. The farrowing/nursery site and the Schaefer, Nohl and Solvie finishing sites may utilize fields containing granular (i.e. sandy or gravelly) soils for liquid manure management. Land application of manure on granular soils has the potential to impact surficial ground water in the area. These operators will need to take steps to protect ground water if they plan fall application on fields comprised of granular soils.

Several of the sites where composting was being used to manage animal mortalities were found to be composting incorrectly. This was brought to the attention of the operators and the State
Board of Animal Health (BAH), and the operators are working with BAH to correct the deficiencies.

**Mitigation Measures**
The measures to be assessed to deal with modeled air emission impacts at the farrowing and Schaefer sites include the following:

- Engineering controls (biofilters; non-thermal plasma; aerobic and anaerobic manure treatment; reduction of pit storage surface area);
- Operational changes (e.g. diet manipulation, pit additives, temperature control);
- Contractual or regulatory mitigation (e.g. easements and/or variances); and
- Institutional mitigation (e.g. right of way relocation and roadway closure--farrowing site only).

The measures to protect shallow ground water from impact from fall application of manure on granular fields at the farrowing, Nohl, Schaefer, and Solvie sites include:

- Operational changes (e.g. move fall application to cohesive soil fields or develop a manure management plan outlining practices to be employed during fall application that will not threaten ground water).

**Farrowing Facility**

**Air.** Several alternatives are analyzed for addressing the modeled air emission impacts from the site. The modeling suggests that the majority of emissions emanate from the nursery barn and therefore the measures would likely need to be focused on that barn. The alternatives analyzed are discussed below.

- Engineering controls (biofilters; non-thermal plasma; aerobic and anaerobic manure treatment; reduction of storage pit surface area; shelterbelts; windbreak walls).

HPP could implement engineering controls at the facility to reduce the emissions generated; treat or disperse the emissions; or provide alternative manure management practices. Treatment of emissions with biofilters or windbreak walls would be a viable method of achieving the needed reduction in emissions from the site. Reducing pit storage areas would likely require significant change to the existing structures. There is little scientific evidence that shelterbelts would
achieve the desired result of emission impact reduction, either through dispersion or treatment, and would likely also take a number of years to become effective in any case. Alternative manure management practices such as non-thermal plasma and aerobic or anaerobic treatment have the potential to be successful, although they may in some cases require changes to the existing structures and capital expenditures to install and operate the equipment. Anaerobic treatment in a reactor vessel, alone among the mitigations analyzed, has the potential for some cost recovery in the form of space heat, hot water, and electricity generation.

- Operational changes (diet manipulation, pit additives, and temperature control).

The evidence is mixed regarding the potential for success in reducing or otherwise mitigating air emissions by use of these methods.

- Variance

HPP could petition the MPCA for issuance of a variance from the applicable air quality standards. If approved, this would address the issue, not by reducing emissions, but by modifying standards applicable to this site.

- Institutional mitigation (right of way relocation and roadway closure).

HPP could petition Stevens and Swift Counties to either relocate the roadway leading past the site farther to the south or totally closing the roadway in front of the facility and turning it into a private access road. HPP would also likely need to purchase sufficient property to move the compliance boundary south of the roadway or obtain an easement from the current property owner for this purpose.

**Ground Water.** To address the threat to ground water from fall application of manure to granular fields, the farrowing/nursery site could either commit to conduct fall application only on fields comprised of cohesive (i.e. clayey) soil, or rewrite its Manure Management Plan for MPCA approval to include procedures for fall application on granule fields that would not threaten ground water.

**Stanley Schaefer Finishing Facility**

**Air.** Several alternatives are analyzed for addressing the modeled air emission impacts from the site. The modeling suggests that emissions from the barns at the site cause a violation of standards owing to the barns’ proximity to the adjacent property. This is true whether or not the third barn is built on this site. It is possible that mitigation measures would need to be focused
on all barns at the site, although measures may not be required at all of the barns to achieve the needed reduction in emissions. The series of alternatives is discussed below.

- Engineering controls (biofilters; non-thermal plasma; manure treatment; reduction of storage pit surface area; shelterbelts; windbreak walls).

Schaefer could implement engineering controls at the facility to reduce the emissions generated, treat or disperse the emissions or implement alternative manure management practices. Treatment of emissions with biofilters or windbreak walls is a viable method of achieving the needed reduction in emissions from the site. Reducing the surface area of pit storage areas would likely require significant change to the existing structures. There is little evidence that shelterbelts would achieve the desired result of emission impact reduction, either through dispersion or treatment, and would likely also take a number of years to become effective in any case. Alternative manure management practices such as non-thermal plasma and aerobic or anaerobic treatment have the potential to be successful, although they may in some cases require changes to the existing structures and capital expenditures to install and operate the equipment.

- Operational changes (diet manipulation, pit additives, and temperature control).

The evidence is mixed regarding the potential for success in reducing or otherwise mitigating air emissions by use of these methods.

- Contractual or regulatory mitigation (easements and/or variances).

Schaefer could attempt to obtain an easement from the adjacent property owner. If obtained, this would address the issue, not by reducing emissions, but by obtaining contractual approval for the emissions to migrate onto private property.

Schaefer could alternatively petition the MPCA for issuance of a variance from the applicable air quality standards. If approved, this would address the issue, not by reducing emissions, but by modifying standards applicable to this site.

Schaefer’s proposal for a third barn at this site envisioned placing it immediately south of the two new barns that he built in 1998, and oriented in the same direction. Should he in the future build this barn but in some other configuration, this could have a significant effect on the emissions analysis, which could be positive or negative. In this event, the air analysis may have to be repeated for the proposal.
**Ground Water.** To address the threat to ground water from fall application of manure to granular fields, Schaefer could either commit to conduct fall application only on fields comprised of cohesive soil, or prepare a Manure Management Plan for MPCA approval that would outline procedures for fall application on granular fields that would not threaten ground water.

**Jon Nohl Finishing Facility**
To address the threat to ground water from fall application of manure to granular fields, Nohl could either commit to conduct fall application only on fields comprised of cohesive soil or prepare a Manure Management Plan for MPCA approval that would outline procedures for fall application on granular fields that would not threaten ground water.

**Jere Solvie Finishing Facility**
Some of the fields used by Solvie for manure application contain granular soils. While Solvie reports that he does not currently apply to granular soils, he may elect to do so at some future point. In this event, to address the threat to ground water from fall application of manure to granular soil fields, Solvie could either commit to conduct fall application only on fields comprised of cohesive soil, or update his Manure Management Plan for MPCA approval to outline procedures for fall application on granular fields that will not threaten ground water.

**Conclusions**
The EIS fully analyzes the ten sites included in the HPP feedlot project. At most of the sites, no potential for significant environmental impact was found. The EIS did find that the HPP farrowing site and the Nohl, Schaefer, and Solvie finishing sites may require mitigation to address air and/or manure land application issues. The EIS lists and analyzes a number of mitigation alternatives for regulatory agencies to use in decision making about regulatory requirements.
1.0 PROJECT OVERVIEW

Hancock Pro Pork, Inc. is a group of feedlot operators who individually own hog finishing facilities and who have joined together to build and operate a farrowing/nursery facility to supply their finishing facilities with feeder hogs. The group also includes two individuals who own no facilities for feeding hogs. These members sell their shares of hogs on the open market.

The Hancock Pro-Pork (HPP) Project is a multi-site hog farrow-to-finish project consisting of one farrowing/nursery facility (five total confinement barns) located in Stevens County (Figure 1-1) that is jointly owned by the Hancock group, and nine finishing sites individually owned by HPP members and located in Stevens and Pope Counties. The project initially consisted of the farrowing/nursery facility, fourteen existing or proposed finishing sites, and one member who planned on buying hogs and subsequently selling them on the open market for finishing. This configuration of the project was the subject of an Environmental Assessment Worksheet (EAW) in 1997. The project was subsequently modified, with some of the original members withdrawing from the project and others joining it, to the current configuration consisting of the farrowing/nursery facility, nine existing or proposed finishing sites, and two members who will sell hogs on the open market for subsequent finishing. A list of the original fourteen finishing sites and those nine finishing sites that remain in the project is given in Table 1-1. This EIS evaluates the currently existing project, made up of the farrowing/nursery facility and the nine finishing sites.

The EAW process ended with a determination by the Minnesota Pollution Control Agency that no EIS was required. That decision was reversed in late 1998 by the Pope County District Court, which ordered the preparation of an EIS.

The project is completely built with the exception of two barns that are proposed by two of the group members and that are discussed in greater detail below. The general location of the individual HPP sites is shown on Figure 1-2.

The EIS must address the farrowing facility as well as all nine finishing facilities associated with the project because the project was proposed at a time when the Environmental Quality Board (EQB) connected action rule (Minn. R. 4410.0200) applied to animal agriculture projects. Under the EQB Rules, projects are connected actions and must be analyzed as a single project if: (a) one project would directly induce the other, (b) one project is a prerequisite for the other, or (c) neither project is justified by itself. Although the connected actions rule still exists in the rules, subsequent modification of the EQB rules in October 1999 eliminated its applicability to animal feedlot projects. Nonetheless, this EIS assesses the individual and cumulative effects of the project in accordance with the connected action rule since the rule was in place at the time of the project application and construction, and as ordered by the court.
HPP and its members have reported that they do not have current plans for further expansion or additional construction at this time. Alan Charles, who originally planned to build a barn for finishing but has not yet done so, and Stanley Schaefer, who at one time notified MPCA and Stevens County of his intent to add a third new barn at his site (in addition to the two built in 1998), were the only members who planned on building new barns after completion of the EIS. Both parties have since notified Stevens County and MPCA (in December 2002) that they now no longer intend to construct those new barns. However, although Charles and Schaefer do not currently plan to build the new barns, this EIS nevertheless evaluates conditions as if the barns would be built in order to account for a future situation in which they change their minds.

The Minnesota feedlot rules (Minn. R. ch. 7020) were revised after the farrowing and finishing site operators submitted permit applications to Stevens County and the MPCA. As required by legislation passed in 2000, the new rules changed the animal unit (AU) calculations for hogs being finished at the finishing sites. The old AU calculation assigned an AU factor of 0.4 for each hog between 55 and 300 pounds. The new AU factor for this weight of hog is 0.3 (meaning, for example, that a 1000-hog finishing barn has a capacity of 300 AU). The new AU factor has been applied to the HPP project hog numbers for consistency.

Six of the nine finishing sites expanded in 1998 to accommodate feeder pigs supplied by HPP. The shareholders who constructed new barns are Greiner, Nohl, Paul, Schaefer, Solvie and Spohr. Charles initially planned to, but did not. If the Charles barn and the third Schaefer barn are constructed, the HPP project would have a capacity of 4806.6 AU. If those barns are not built, the HPP project would have (and now has) a total capacity of 4206.6 AU.

Three of the six expanding finishing sites (Nohl, Greiner, and Solvie) received Certificates of Compliance or permits prior to the issuance of the EAW negative declaration decision on the need for an EIS by the MPCA on October 28, 1997. The Schaefer, Paul and Spohr sites were issued Certificates of Compliance in 1998, after the negative declaration by MPCA.

Two finishing sites, Olson and Zeltwanger, have not expanded and report no plans for expanding operations. The only change at these sites is that HPP would be the source of feeder pigs.

The remaining shareholders, Craig Swenson and Chad Solvie, have no facilities and do not finish their shares themselves, but instead sell their shares of hogs on the open market.

1.1.1 Chronology of Events

A chronology related to the HPP project since 1997 is shown on Table 1-2. A brief summary of the project history is given in this section.
MPCA began receiving information on the HPP project in April 1997. That information included a faxed map from Stevens County showing the proposed farrowing/nursery site and those HPP finishing sites located in Stevens County. The project triggered the mandatory EAW category for the farrowing and finishing facilities based on the EQB connected action rule. In late June of 1997, HPP submitted design documents to the MPCA, as well as an EAW “completed data portion” and a “finisher supplement,” which for the first time brought the sites located in Pope County to MPCA’s attention.

MPCA issued Certificates of Compliance to four of the project’s finishing sites during this same time period, despite the fact that there was an environmental review process pending and the rules prohibit final permitting decisions until it is completed. One was issued because MPCA determined, in response to a query from the proposer, that the project in question had been planned, and substantial steps taken toward its construction, well before the Hancock project was organized, and was therefore not a connected action. Two others were issued early because at the time of issuance MPCA staff did not know that the sites in question (located in Pope County) were part of the Hancock project. The fourth was issued shortly before the negative declaration because, although MPCA Environmental Review staff then knew that the site was part of the Hancock project, the MPCA permitting staff had not been so informed. The latter site is no longer a part of the Hancock project.

Following submittal of the HPP documents, the MPCA distributed an EAW on the project for public comment on August 7, 1997. The MPCA Citizens Board issued a negative declaration on October 28, 1997, indicating that an EIS on the project was not required. In November 1997 Pope County Mothers and Others Concerned for Health (PCMOCH) and Peters Sunset Beach, Inc. filed suit against the MPCA, challenging the negative declaration decision by the MPCA Citizens Board in October of 1997. HPP intervened in the court action and participated in all briefings and oral arguments.

Subsequent to the negative declaration by the MPCA Citizens Board, the MPCA completed initial computer modeling of air emissions from the farrowing/nursery site and concluded that emissions of hydrogen sulfide would potentially exceed state air quality standards.

Since no order was sought or obtained prohibiting project construction and operation pending the outcome of litigation, HPP proceeded to obtain regulatory approvals and construct the jointly owned farrowing/nursery site while the litigation was in process. Likewise, most members completed construction of new barns at their sites to house feeder hogs they planned to obtain from the farrowing/nursery site. On February 19, 1998, the MPCA issued Interim Permit MPCA-I 2358(A) to HPP for planning, construction, and operation of the five total confinement barns at the HPP farrowing/nursery site. Construction of the first gestation barn was completed in August 1998 and hogs were delivered to start the farrowing operation at that site. By December 1998, all of the barns at the farrowing/nursery site were completed and all of the
expanding finishing sites had completed construction, with the exception of the single barn at the Charles site and the third barn at the Schaefer site.

1.1.2 Decision to Prepare EIS

On September 30, 1998 the Pope County District Court issued a decision indicating that an EIS was required for the site. On November 23, 1998, the Court amended its order, but still required that an EIS be completed. On January 11, 1999, HPP appealed the District Court ruling to the Minnesota Court of Appeals, and on May 25, 1999, the appeals court affirmed the original decision that remanded the matter to the MPCA for the preparation of an EIS.

The court concluded that the MPCA erred in issuing the negative declaration and ordered an EIS be completed based on the reasoning listed below. The court found that:

- a substantial portion of the project was issued certificates of compliance or permits in violation of Minnesota law;
- the negative declaration relied upon pollution prevention measures that were not applicable to each of the finishing sites; and
- substantial evidence did not support MPCA's conclusions that hydrogen sulfide did not present a potential for significant environmental effect.

While the Appeals Court was reviewing the HPP appeal, the MPCA developed and released a draft EIS scoping document and held public meetings to discuss the scope of the EIS that would be prepared if the appeal of the EIS order were to fail. On July 27, 1999, the final Scoping Decision Document was approved by the MPCA Citizens Board with the guidance to staff to minimize EIS costs to HPP by making maximum use of the Generic Environmental Impact Statement on Animal Agriculture (GEIS) that was being developed by the EQB, in lieu of the usual EIS data gathering activities, wherever possible. The Scoping Decision Document defined the project that would be reviewed in the EIS as including the original farrowing/nursery site and nine finishing sites. The Notice of Intent to Prepare an EIS was published in the EQB Monitor on September 6, 1999.

The Scoping Decision Document was used to solicit competitive proposals from private sector consulting firms. Based on those proposals, a consultant team consisting of Liesch Associates, Inc. (Liesch), Impact Assessment, Inc., and Gantzer Environmental Software and Services, Inc. (Gantzer Environmental) was selected to assist with writing the EIS. The MPCA subsequently negotiated with the Liesch/Gantzer Environmental team to revise their costs to remove all overlap in the services to be provided by the two firms. Contracts to retain these two consultants were then prepared.
The final negotiated cost and scope were then incorporated into a draft contract document that was the basis of the development of the MPCA Cost Agreement with HPP. The draft Cost Agreement was sent to HPP by the MPCA on May 3, 2000.

1.1.3 Cost Dispute

Minn. R. 4410.6000-6200 provides that the project proposer is to be assessed the RGU’s reasonable costs for EIS preparation. Minn. R. 4410.6410 provides for the resolution of disagreements between RGU and proposer regarding project costs and assessments.

MPCA staff worked with Hancock representatives from May through August 2000 to negotiate an EIS cost agreement between MPCA and HPP. At the end of that negotiation period, HPP informed the MPCA that a disagreement existed. In mid-August, the MPCA served HPP with a copy of its request to the EQB for resolution of the dispute in accordance with the administrative procedure that is prescribed in the EQB rules for resolving cost disagreements. The EQB considered the matter in their September, October and December regular meetings without coming to a conclusion. On December 20, 2000, HPP petitioned the MPCA to terminate the EIS and concurrently requested that EQB defer further action on the cost agreement dispute until the EIS termination request was resolved. A key issue that HPP based the request on was the October 1999 change in the EQB rules that eliminated the connected action rule’s applicability to animal feedlots.

The MPCA Citizens Board item on the HPP petition was mailed to all interested parties on January 12, 2001. HPP filed a Memorandum in Support of Request to Terminate EIS on January 18, 2001. The January 18 memorandum was followed by a supplemental memorandum from HPP dated January 29, 2001. A revised Board item was then developed and mailed to interested parties on February 1, 2001.

At a special meeting on February 7, 2001, the MPCA Citizens Board denied HPP’s request to terminate the EIS and denied an accompanying request for a contested case hearing.

Following the denial of the HPP request, the EQB adopted an Order dated April 9, 2001 outlining the estimated costs that MPCA could assess to HPP for EIS preparation. As part of the resolution of this issue, EQB agreed to provide the funding for the air impact assessment analysis to be completed by Gantzer Environmental. EQB also ordered that MPCA reduce its assessment to Hancock for the Project Description, Socioeconomic, and Alternatives portions of the EIS.

Ultimately, Hancock Pro Pork paid $19,614; EQB paid $51,628; MPCA paid $95,030; and a special legislative appropriation of $192,000 paid the rest.

With the final EQB order in hand, MPCA executed a contract with Gantzer Environmental for the air impact assessment in April 2001. However, although Gantzer Environmental began the
air assessment immediately, a number of factors prevented this work from proceeding to completion at that time.

First, the funding made available by EQB for the air assessment work extinguished at the end of the fiscal year, on June 30, 2001. Gantzer Environmental was able to spend only about half of this money before the fiscal year ended, and another source for the rest did not, for the moment, exist. Second, shortly after this work was started, the State of Minnesota was forced to begin preparations for a statewide government shutdown due to the failure of the legislature to pass an appropriations bill in the 2001 regular session. Third, the $192,000 appropriation to fund the remainder of the EIS work—including the work to be done by Liesch Associates, the other MPCA consultant in this case—was in the appropriations bill that failed in the regular session; without knowing for sure that this appropriation would be available, MPCA was prevented from executing the Liesch contract, and was similarly forced to suspend the Gantzer Environmental contract as of the end of the fiscal year.

Although passage of funding legislation in the 2001 Special Legislative Session narrowly averted a state government shutdown and provided the funding needed to continue the EIS work, the legislation appropriated the air money to EQB and the remainder to the state Department of Agriculture, rather than MPCA. In both cases, Interagency Transfer Agreements (ITAs) had to be worked out between MPCA and the other agencies to provide for transfer of the funding to MPCA.

HPP executed the final cost agreement with MPCA on September 13, 2001, and the ITAs were completed at about the same time. This cleared the way for MPCA to restart the Gantzer Environmental contract and complete the Liesch contract. The consultants’ work on the EIS then moved forward.

1.2 Scope of EIS

The major issues that emerged during the environmental review process and the associated judicial review included the following:

- Impacts of the project on ground water and surface water;
- Impacts of the project on wildlife and wildlife habitat;
- Assessment of the air emissions and odors anticipated from the project; and,
- Potential impacts associated with the proposed manure management practices.

To address these major issues, the EIS includes a review and assessment of the following:
A project description that provides sufficient detail to identify the project purpose, size, scope, environmental setting, location, and anticipated phases of development;

A review of resources and other impact receptors that are present in the area and could be affected by the project;

A review of the laws, rules and regulations pertinent to the project and the associated governmental approvals required for the project;

An assessment of the potential impact associated with the individual facilities of the project and the associated cumulative effect from the project and other sources;

An assessment of past and current compliance with rules and requirements, considering that the majority of the project is built and operating;

A review of mitigation measures that could be implemented to reduce or eliminate any potentially significant adverse effects of the project;

A review of alternatives that could be implemented at individual facilities to address environmental effects from the project (by EQB Order, the review of alternatives excluded a review of alternative sites for project facilities); and,

A review of the socio-economic effects that the project may have in the area (by EQB Order, the cost, and thus scope, was limited to a review of the GEIS information on the socio-economics of animal agriculture and, generally, how those findings may be related to the project).

### 1.3 DATA SOURCES USED FOR THE EIS

At the initiation of the EIS work, data on characteristics, makeup, management, size, configuration, location, future plans, and other attributes were collected and compiled for each of the project locations. The existing and planned design and operation of each element of the project were identified for use in defining the project for review. These data were used as the basis of the analysis and assessment work in the preparation of the EIS as provided in the final Scoping Decision Document and Final Draft Workplan, as amended by the EQB Order.

Relevant background water and air quality data from MPCA staff, local government agencies, published literature and other sources were compiled during this project. This includes the air monitoring and ground water sampling that were performed at HPP sites by MPCA staff. The GEIS was extensively utilized as a data source to assess the socioeconomic effects that the project may have and was also used as a resource for considerable other pertinent information for
the project. Applicable local and state organizations provided information used to define the natural habitat of the project area.

The data sources used are summarized below:

**Ground Water and Surface Water**
Information was collected from the Minnesota Geological Survey, Minnesota Department of Health, Natural Resource Conservation Service (NRCS), MPCA, United States Geological Survey (USGS), Minnesota Department of Natural Resources, and Pope and Stevens Counties. A literature search of pertinent information was completed which included a review of GEIS documents, as well as Internet and library searches for articles covering information lacking in the GEIS. Information provided by HPP members and area residents was also utilized for the EIS.

**Facility Design and Operation**
Information from MPCA files, a project tour, and subsequent follow up work provided most of this information. The tour was taken on November 19-20, 2001, and included contacts with most of the HPP members and others to seek information and discuss the overall project. The consultants also initiated numerous follow-up contacts with project members. The State Board of Animal Health inspected each site for compliance with animal mortality management requirements and provided information on its mortality management rules, programs, and policies.

**Air Quality**
The CALPUFF air quality computer model (see Section 4.1.1) was used to assess the potential air quality impacts associated with the Hancock project. In addition to the spatial coordinates provided by the Liesch project group, the required model inputs included feedlot gas emission rates and meteorological data. Gantzer Environmental determined the hydrogen sulfide and volatile odorous organic compound (VOOC) emission rates for the hog barns based on measured gas concentrations inside the barn and on calculated air exchange rates. Ammonia emission rates for the hog barns were based on published ammonia emission factors. For manure basins, Gantzer Environmental calculated the hydrogen sulfide, ammonia, and volatile odorous organic compound emission rates as a function of wind speed by means of established emission algorithms based on the measured liquid-phase chemical concentrations in the basin.

The required meteorological input file was developed from several types of weather data including on-site wind data, surface weather conditions, and upper air conditions. The on-site wind direction and wind speed data were obtained from the meteorological station operated by the MPCA at the Hancock farrowing site. The air temperatures and other surface weather data were for the Minneapolis weather station. The upper air data used for the analysis were from the...
Chanhassen, MN weather station. The on-site wind data, the Minneapolis surface weather data, and the Chanhassen upper air data were combined into the required meteorological input file.

Both on-site and regional climatological information was also collected for use in the modeling efforts.

**Socioeconomic analysis**
Project staff reviewed socioeconomic data in the GEIS on feedlots and compared it to the project to assess the applicability of the findings in the literature to the Hancock project.

**Wildlife Habitat**
Information obtained from the Minnesota Department of Natural Resources and US Fish and Wildlife Service was collected to identify and characterize wildlife habitat in the project area. Information was also sought from Internet and University of Minnesota literature searches for information regarding impacts associated with hog facilities.

### 1.4 **OVERVIEW OF EIS**

This draft EIS is comprised of eight Sections as described below:

**Section 1.0 Introduction**
This section summarizes project history, identifies the scope of the project, and identifies the data sources utilized for the project.

**Section 2.0 Project Description**
The project description identifies the pre-project operational characteristics of each of the ten HPP facilities. It also presents a description of the project as built, highlighting those new elements that were added to the pre-project facilities. The section reviews the feed and pharmaceuticals used at each site and the status of the various permits for the facilities, although reviewers are cautioned that use of chemicals at feedlots is never constant, but changes in response to operator perceptions of efficacy. **Section 2.0** also reviews pertinent laws and regulations that affect this project.

**Section 3.0 Environmental Setting**
This section reviews the regional and site specific characteristics of the project area, including regional climatological and air quality information, regional geologic and hydrogeologic conditions in the area, regional surface water hydrologic considerations, and the regional ecology of the area. It also reviews public health considerations related to the project and the socioeconomic conditions of the area as outlined in the GEIS, as well as the site-specific environmental setting of each of the ten proposed project sites. This information is used as the basis for assessing environmental impacts of the project.
Section 4.0 Environmental Impact of Project
The computer modeling completed as part of the EIS is presented and discussed in detail. The results of the modeling identify potential violations of air quality standards and identifies the sites that may require mitigation.

The potential for the project to cause environmental impacts on ground water resources is assessed. Existing wells and other ground water features with the potential to be impacted are identified. The types of impacts that may result from improper manure management are briefly discussed, as is the potential for pathogens and toxic contaminants to significantly affect human health and the environment.

The project areas are characterized in terms of existing surface water drainage and receiving waters, especially the Chippewa River, the Pomme de Terre River, and the Danvers Wildlife Management Area, and the potential for the project to cause impacts to surface water resources is assessed. Existing and planned mitigation and other impact control measures are identified and their adequacy assessed. Potential further and more extensive mitigation measures are addressed in Section 5.0 Mitigation Measures.

The potential effects on the regional ecology and public health are reviewed and the need for mitigation to address identified impacts is presented. The likely socioeconomic effects of the project are discussed in general terms based on information from the GEIS.

Section 5.0 Mitigation Measures
This section includes an analysis of the anticipated effectiveness of the facilities in achieving environmental protection goals over the operating life and a discussion of current and possible future state and/or federal laws that may have an impact on how the Hancock project and the no-build alternatives are operated. In the event that mitigation measures over and above those planned or in place may be required, such mitigation measures are identified and reviewed.

Section 6.0 Mitigation Alternatives
This section identifies the alternatives that may mitigate pit barn air emissions and water resource impacts, and the appropriate changes to operating practices to protect against violations. The specific alternatives that are applicable to each individual site are presented.

Section 7.0 Alternatives Analysis
This section reviews alternatives that could be implemented if there are existing or potential environmental effects that cannot be mitigated as outlined in Section 6.0 Mitigation Alternatives above. The list of appropriate alternatives for the project includes:
• No Build;
• As-Built; and
• Mitigated As-Built.

Section 8.0 Cited References

This section lists the references cited in the report.

Note: Discussion of any trademarked or other product or service information within the EIS is solely for identification of the products used and their associated characteristics. Any reference to such products or services is not to be considered an endorsement or approval by the MPCA or the authors of this EIS.
2.0  PROJECT DESCRIPTION

2.1  GENERAL PROJECT INFORMATION

The HPP Project is a farrow-to-finish operation consisting of one farrowing/nursery facility, owned by the cooperative members, and nine finishing facilities, eight of which are built and operating and one (Charles) that was at one time proposed. Two additional members obtain their share of hogs from the farrowing operation and re-sell them on the open market. Five of the current finishing sites had pre-existing feedlot operations prior to the HPP project (Solvie, Spoehr, Schaefer, Olson, and Zeltwanger). The locations of these pre-existing operations are shown on Figure 2-1. Schaefer, Solvie, Spoehr, the farrowing facility, Greiner, Nohl, and Paul all built new hog barns as part of the HPP project, some at their existing sites and some on virgin sites. Charles initially proposed to build a new barn on a new site, but has more recently (in December 2002) stated that he may not build this barn, and may withdraw from the group. Schaefer, who built two barns to house HPP hogs in 1998, subsequently proposed to build a third barn on the same site, but has more recently (in December 2002) stated that he may not do so. Nonetheless, this EIS reviews the Charles and Schaefer facilities as if these barns will be built, in order to account for a possible future scenario in which they change their minds. In addition, the MPCA was recently informed (October 2002) that Zeltwanger may also withdraw from the HPP group.

MPCA and Stevens County issued Certificates of Compliance to several HPP finishing facilities in 1997-1998. Under the prior MPCA feedlot rules, MPCA and delegated counties used the certificates as a regulatory tool to acknowledge that the facilities met MPCA requirements based on the feedlot conditions and operational practices known by the regulatory agency at the time the certificate was issued. The certificates were letters from the MPCA or delegated county that typically contained a facility description (e.g. structures, animal types and units, etc) and a list of operational and management practices that existed or would be implemented by the facility owner. Certificates of Compliance are no longer being issued under the amended MPCA feedlot rules. However, a comparison of a prior Certificate (and its incorporated list of operational and management practices or conditions) with current feedlot operations provides some insight into a particular feedlot’s potential compliance with current MPCA requirements and conformance with accepted agricultural pollution prevention practices. For the purposes of the EIS, MPCA conducted a review of the operations of the HPP finishing facilities that were previously issued certificates to determine whether the current feedlot operations conform to the certificates’ provisions regarding manure application to granular soils. Those reviews are discussed in this EIS.

Under the old feedlot rules, the Olson and Zeltwanger feedlots were also nominally required to obtain Certificates of Compliance, and the operators applied for them, but they were never issued because they were not required at feedlots that were not being modified in some way and had no
known pollution hazards. The rules now in force do not require regulatory approvals for facilities of such small size. All operating feedlots in the project are, however, currently registered with either Stevens or Pope County, as required in the new rules.

The farrowing facility and the finishing sites that constructed new barns used similar designs, with concrete pits underlying barns with concrete slatted floors. All of the new barns are of single story, stud wall construction, with steel siding and roofs. Dimensions of the finishing barns and pits may vary slightly from site to site, but are approximately 200 feet long by 40 feet wide. Concrete pits are 8-10 feet in depth and all newly constructed pits were outfitted with perimeter tile drains.

The farrowing facility farrowing barn differs from the other new barns in that it has a shallow pit underneath that drains to the gestation barn pits.

Barn details for each site are discussed in Section 2.3. The new buildings are curtained for natural ventilation when weather permits, and are power ventilated in the winter, except for the farrowing site nursery barn, which is hard-sided and is mechanically ventilated year round. Table 2-1 summarizes the pre-project and post-project site characteristics.

The manure management practices for the sites operating prior to the HPP project included scrape and haul at some sites, liquid manure storage at the others, and land application for all. Approximately 2,082 acres were available for manure spreading prior to the HPP project. The current acreage reported and/or previously utilized by HPP members for manure spreading is approximately 9,130 acres, which represents a net increase of 7,048 acres. The specific details of each project facility are provided below.

It should be noted that animal unit totals at feedlots can vary over time depending on market conditions, operator decisions, and other factors, although they may be limited by applicable rule and permit provisions. The animal unit figures used in this EIS were accurate at the time of site data gathering and compilation for this EIS.

There are numerous pre-existing odor sources in the HPP project area (see Figure 2-2), some of which are feedlot operations. Gantzer Environmental utilized these odor sources in the regional odor assessment that is part of the air-modeling component of the EIS.
2.2 General Practices

2.2.1 Hog Feed and Additives for Farrowing and Finishing Sites

The farrowing facility and the finishing sites use specific mixtures of feed additives and meal for each hog type. All feed mixtures contain percentages of corn meal and soybean meal. General feed mixes for types of hogs from nursery to finishing hog are included in Appendix A.

Each feed type is supplemented with specific ingredients and additions such as fish meal (nursery hogs), white grease for sows and boars, and Land O' Lakes Lean Gain Hog Grower Mix™ and Paylean® for finishing hogs. Table 2-2 provides a summary of the characteristics and recommended dosage of the feed additions and pharmaceuticals used at the HPP sites. Paylean® is a pharmaceutical product that causes a hog's metabolism to shift nutrients from fat to muscle growth. Premixes are added to the feed containing varying percentages of phosphorus, calcium, copper, selenium, zinc, amino acids such as lysine and methionine, and vitamins A, D₃, and E.

Low dosages of antibiotics are employed to prevent disease outbreaks and increase the rate of weight gain and feed efficiency. If disease does occur, the drug dosage is typically increased until the outbreak is under control. Other pharmaceuticals may be administered over a recommended period to treat affected hogs. This is standard practice in the industry.

All of the HPP facilities use the pharmaceutical Tylosin Phosphate (Tylan®) and most use Chlortetracycline Hydrochloride (Aureomycin®). The remaining pharmaceuticals and additives identified in Table 2-2 are used at other finishing sites within the project at specific frequencies and dosages. Reviewers are cautioned that chemical use at feedlots is not to be regarded as constant, but variable over time according to operator perceptions of efficacy for the intended purpose. The chemical use addressed in this EIS is that which was known at the time of publication.

2.2.2 Pit Additives

The two pit additives that are or have been proposed for use by the HPP members are Liqui-Blue™ (trademark of Link Agri-Products) and Barrier® (registered by Agriliance). Liqui-Blue™ is currently used at three feedlots within the HPP project to break down solids and reduce odors released from liquid manure. Barrier® is being considered for use in conjunction with Liqui-Blue™. Table 2-3 gives descriptions, active chemical concentrations, and environmental information on these products.

Liqui-Blue™ is a Canadian product that contains enzymes to break down manure solids for ease of pumping. The chemical reactions performed by the enzymes are said to increase aerobic manure digestion that dislodges the solids from the bottom of the pit, minimizing clogging in land application equipment and maximizing the ability to clean out manure pits. This breakdown
of solids is said to help reduce odors when manure is land applied. The active ingredients in Liqui-Blue™ are copper sulfate and sulfuric acid. Liqui-Blue™ is used in conjunction with other products to adjust pH and adjust the counts of bacteria within the manure pit. The manufacturer claims that the mixture is environmentally friendly (Link Agri-Products 2001). However, no data is given to support this claim.

Barrier® is a soy-based product mixed with isopropanol and a chemical mixture containing 1-4 Dioxane and ethylene oxide. Barrier® is said to form a film on the surface of the manure in the pit, thus trapping odors beneath the surface. The manufacturer claims Barrier® can reduce ammonia and hydrogen sulfide emissions up to 40% and 75%, respectively.

Reviewers are cautioned that chemical use at feedlots is not to be regarded as constant, but variable over time according to operator perceptions of efficacy for the intended purpose. The chemical use addressed in this EIS is that which was known at the time of publication.

2.2.3 Manure Application Practices

Animal manure has value as crop fertilizer due to the high nutrient content (nitrogen and phosphorus) necessary for healthy plant growth. All HPP feedlot operators use manure as fertilizer for their crops. Five of the ten sites have or propose to have only liquid manure operations and most contract with one or more certified manure applicators to land apply the liquid manure. Two operations are scrape and haul operations, stockpiling and spreading solid manure onto available acreage. Three sites are "combination sites", either currently or in the past operating scrape and haul operations in conjunction with liquid manure management operations. Site-specific details are discussed in Section 2.3.

Manure application rates must be limited by the nutrient needs of the crops and the availability of nutrients in the soil, in order to minimize the potential for environmental impacts. Maximum manure application rates are restricted based on crop-available nitrogen in the soil (MPCA 2001d). Under the rules, the larger HPP operations (greater than 100 AU) must conduct periodic manure and soil nutrient testing to determine the appropriate manure application rates on soils. The smaller operations (less than 100 AU) are allowed to use published agronomic data and expected manure nutrient values to determine nutrient content in soil and manure. At these smaller operations testing is not required. Site-specific practices are discussed in Section 2.3.

Minn.R. 7020.0300 subp. 23 defines a 300-foot buffer strip around certain specified wetlands and most intermittent streams and ditches as a “special protection area.” Minn. R. 7020.2225 subp. 6 places restrictions on manure application within special protection areas, including setbacks from the wetland, intermittent stream, or ditch and allowable phosphorus levels in the soil. All HPP operators must observe these requirements as applicable, and they report that they do so.
2.2.4 Mortality Management

The HPP farrowing site and the finishing sites dispose of dead animal carcasses by composting, burying, using a rendering service to pick up the carcasses, or (at the farrowing site only) incinerating animal carcasses (see Table 2-6). Operations that compost typically employ practices that include a pile near their barns, adding straw and/or manure in specific proportions to aid in composting, and then applying the finished compost material to a nearby field. Sites that bury the dead animals report excavating a hole in the ground, placing the mortalities in the excavation and covering with soil. Sites that contract with a rendering service temporarily store the mortalities outside and call the rendering service for pick up. The farrowing site freezes the mortalities that it has picked up for rendering. Most of the sites have reported using varied animal mortality management practices from time to time. Site-specific practices are discussed in Section 2.3.

2.3 SITE SPECIFIC PROJECT INFORMATION

2.3.1 Farrowing Facility

The farrowing facility site is located in Section 34, T123N, R41W, Moore Township in Stevens County, Minnesota. The site is approximately 6 miles south of Hancock, Minnesota off Hwy 1 (Figure 1-2).

The farrowing facility houses 8000 piglets, 2424 sows, and 60 boars. The total Animal Unit (AU) capacity for the site is 1393.6.

2.3.1.1 Pre Project Description

The farrowing facility site was cropland before the HPP project. No buildings were on the site prior to construction. Seven residences lie within a one-mile radius. A site plan of the pre-project condition is shown on Figure 2-3.

2.3.1.2 Post-Project Description

The farrowing facility consists of five total confinement barns with slatted floors draining into concrete pits of various depths beneath each barn. The concrete pit beneath the farrowing barn drains by gravity to the three gestation barn pits through piping connecting the pits. Plugs in the piping are manipulated to control manure flow from the farrowing barn pit to the gestation barn pits. Perimeter tile drains are installed around and below the concrete pits, and are designed to lower the water table near the pits. HPP reports that the perimeter tile drains have always been dry. See Tables 2-1 and 2-4 for facility site characteristics.

Two septic tanks handle the wastewater from the offices, which house toilet and showering facilities, prior to draining into the concrete storage pits beneath the barns. Two wells (Unique
Well Numbers (UWN) 595418 and 595419) used for domestic and operational purposes were installed on the facility property near the parking lot on either side of the driveway. The wells are 208 and 209 feet deep, respectively. The site plan for the facility is shown on Figure 2-4.

The manure management plan for the farrowing/nursery facility provides that all storage pit contents are pumped and land applied during the spring and fall of every year. Full capacity of the storage pits is approximately 4.2 million gallons, which is approximately 14 months of storage, based on theoretical manure waste production rates.

In 2000, 4.1 million gallons of liquid manure were land applied to 551 acres in 7 fields. In 2001, 5.86 million gallons of liquid manure were applied to 571 acres in five different fields over two different application periods (spring and fall). The increase in manure generation in 2001 is reportedly due to additional cleaning and disinfection conducted in 2001, and may not represent routine manure generation. The locations of the land application fields are shown on Figure 2-5. Refer to Table 2-5 for yearly land application rates, testing results, and application locations for all sites. The 2002 MMP indicates that the farrowing/nursery facility has approximately 1561 acres available for use for land application of manure.

The farrowing site uses the land of other farmers for manure disposal. If the farrowing site is to continue to use other farmers’ fields for manure application (such as Olson’s), the farrowing site must have the appropriate field and application information within their MMP, perform field and manure testing, keep the appropriate land application records, and provide the field owners with the appropriate information for their records so that both the farmer and farrowing facility can show that nutrients from all sources were applied at agronomic rates. Therefore, HPP-FF must update their MMP annually and keep the updated MMP and annual manure application records available on site as required. Because HPP-FF has agreed to follow the conditions of the expired Interim Permit, they have been submitting the annual manure application records to MPCA each year.

Summaries of the farrowing facility feed components are included in Appendix A and feed additives are summarized in Tables 2-1 and 2-2 and discussed in Section 2.2.1.

Adult animal carcasses are frozen and picked up by a rendering service. The facility also operates an incinerator for carcass management, but uses it primarily for piglet mortality management. Ashes from the incinerator initially were buried on site. This is not permitted, so MPCA has directed the farrowing site to thin spread the ash on different locations in fields instead. Mortality management for the facility is summarized in greater detail in Table 2-6.
### 2.3.2 Alan Charles Feedlot

Charles submitted two permit applications in 1997 to build one finishing barn on one of two separate properties in Stevens County: Section 32 in Hodges Township or Section 4 in Moore Township. Charles informed the Stevens County Feedlot Officer on February 18, 1999, that he had decided to build the feedlot in Section 4, T123N, R41W, Moore Township in Stevens County, Minnesota. The site is less than 1/2-mile west of Hancock, Minnesota on County Road 8. The above permit applications are now outdated. Charles has not submitted a new permit application or updated construction plans for the feedlot to comply with the new rules and has recently notified the county that he currently does not intend to build. Permission to build cannot be granted until an application is resubmitted and updated plans are approved, and this EIS is completed.

#### 2.3.2.1 Pre Project Description

The Alan Charles proposed feedlot site currently consists of a house and garage that are intermittently occupied. There are no current plans to demolish the buildings. A 110-foot residential well (UWN unknown) is located on this site for household and planned livestock use. Ten rural residences and a portion of the town of Hancock are within a one-mile radius of the site. A site plan of pre-project conditions is shown on Figure 2-6.

Currently, Charles contracts for raising his share of hogs at various sites in Minnesota. Most recently, Charles reports that he contracted for his hogs to be raised at two different facilities; one near Dawson, Minnesota, and the other in Swift County. The lightest weight hogs from each of these facilities have been delivered to the farm of Harold Charles, Alan’s father.

#### 2.3.2.2 Post Project Description

One barn was initially proposed for the Charles project site and would be built south of the existing house and shed (note that Charles has notified the MPCA that he currently does not intend to build this barn). The facility’s general site characteristics are listed in Table 2-1. The site plan for the facility is shown in Figure 2-7. The proposed barn would, if built, have slatted floors that drain into an 8-foot concrete pit, and would house 500 grower and 500 feeder hogs. The total proposed AU for the site is 300. The pit would have a perimeter tile that would drain to a nearby road ditch. Barn and pit attributes are listed in Table 2-4.

The pit would be pumped annually and the liquid manure land applied on some of the 1183 acres of fields available to Charles. Manure storage capacity would be approximately 435,000 gallons, translating into approximately 10 months of storage based on theoretical manure production rates. The site’s planned manure land application practices are summarized in Table 2-5. The land application loading rates would depend on test results from manure and soil before land
application is performed. Land application fields for the Charles feedlot are illustrated on Figure 2-8.

Feed, additives, and medications would likely be the same as those discussed in Section 2.2.1 and Tables 2-1 and 2-2.

If he builds his facility, Charles plans to compost animal mortalities on an old concrete bunker using a straw-manure mixture as the bulking material. Charles plans to turn the pile every three months and when composting is finished, apply it to nearby fields. Planned mortality management practices are summarized in greater detail in Table 2-6.

2.3.3 Gary Greiner Feedlot

The Greiner site is located in Section 2, T123N, R40W, Hoff Township in Pope County, Minnesota. The site is approximately 9 miles east of Hancock, Minnesota on 350th Avenue. The MPCA issued a Certificate of Compliance for feedlot construction in 1997, and revised it in June 1998.

2.3.3.1 Pre Project Description

Previous to HPP related construction, the site consisted of a house and a storage garage, both of which have since been demolished. A 75-foot residential well (UWN 595404) is located on-site. Three residences lie within a one-mile radius. A site map illustrating the pre-project condition is shown on Figure 2-9.

2.3.3.2 Post Project Description

The site plan for the facility is shown on Figure 2-10. One total confinement barn with slatted floors over an 8-foot concrete pit was constructed for the HPP project in October 1997. The barn houses 1000 grower and feeder hogs for an AU total of 300 for the site. The pit is emptied and pumped once a year and the liquid manure is applied to the 448 acres available. Manure storage capacity is approximately 435,000 gallons, which translates to 10 months of storage based on theoretical manure production rates. Actual manure production rates from the facility indicate that the facility has approximately 14 months of storage under current management practices. The conservative water use practices at the facility decrease the amount of wash water entering the pit, allowing for longer storage in the pit before the ultimate capacity is reached. Table 2-1 summarizes the facility’s site characteristics and Table 2-4 lists barn and pit attributes.

The locations of the land application fields are shown on Figure 2-11. Greiner estimates manure spreading rates of approximately 4000 gal/acre/yr. on 90 acres since 1998. Manure management operations are summarized in Table 2-5.
Feed components are the same as those discussed in Section 2.2.1. Greiner pharmaceutical use is listed in Table 2-2.

Greiner reports that he uses a rendering service that picks up carcasses as needed. An old compost pile or burial site was noted during the site visit in 2001. When asked about this, Greiner explained that they sometimes bury carcasses because it is more convenient. Mortality management for the site is summarized in greater detail in Table 2-6.

2.3.4 Jon Nohl Feedlot

The Nohl site is located in Section 24, T123N, R42W, Moore Township in Stevens County, Minnesota. The site is approximately 6 miles south of Hancock, Minnesota. Stevens County issued a Certificate of Compliance (STEV-C 031) for feedlot construction in 1997, and revised it in February and June of 1998. Table 2-1 lists the facility’s general information and Table 2-4 lists barn attributes.

2.3.4.1 Pre-Project Description

Before the HPP project, the Nohl site had a house, garage, and an old shed. The pre-project site conditions are shown on Figure 2-12. A 98-foot residential well (UWN 595401) is on-site for household and livestock use. It is approximately 200 feet NE of the northernmost new barn. Four residences lie within a one-mile radius.

2.3.4.2 Post-Project Description

The north total confinement barn was built in 1997 with slatted floors over an 8-foot deep concrete storage pit. The south total confinement barn was built in 1998 with slatted floors over an 8-foot concrete storage pit. A passageway connects the north and south barns. Each barn houses 500 grower/feeder hogs and 500 finishing hogs for an AU total of 600 for the site. A site map illustrating the facility’s layout is shown on Figure 2-13.

The north barn and south barn have approximate capacities of 426,500 gallons each, for a site capacity of approximately 853,000 gallons. This translates to 10 months of storage based on theoretical manure production rates. Actual manure production rates from the facility indicate that the facility has approximately 19 months of storage under current management practices. The conservative water use practices at the facility decrease the amount of wash water entering the pit, allowing for longer storage in the pit before the ultimate capacity is reached. Nohl reports that he uses Liqui-Blue® to help break down the solids and make land application easier. Pit additive details are discussed in Section 2.2.2. Table 2-3 describes Liqui-Blue® and additional products used in conjunction with Liqui-Blue®.
Gravity perimeter tile drains surround the concrete pits. The drains lead to the property perimeter ditch (approximately 100 feet from the north barn) that eventually drains to Judicial Ditch #9 over one mile from the private ditch.

Manure management practices are summarized in Table 2-5. The liquid manure from the two barns is land applied on 1,032 available acres. Land application sites are shown on Figure 2-14.

Feed constituents were discussed in Section 2.2.1. Table 2-2 summarizes pharmaceutical use at the Nohl feedlot.

Animal mortalities are managed by composting. Nohl began composting approximately one year ago. Previously, Nohl buried the carcasses near the current compost pile location. The composting site is located on the south side of the barns. Mortality management practices are summarized in Table 2-6.

2.3.5 Mike Olson Feedlot

The Olson site is located in Section 26, T123N, R42W, Moore Township in Stevens County, Minnesota. The site is approximately 3 miles south of Hancock, Minnesota off County Road 53. Olson completed a permit application in 1997. However, since there was no new construction associated with the HPP project, a Certificate of Compliance was not issued. Facilities that were not being modified did not require them, and permits often were not issued to such facilities.

2.3.5.1 Pre Project Description

Prior to the HPP project, the site consisted of a house, three partial confinement barns and three open lots. A machine shed provides storage space for facility equipment. There are four shallow wells at the site, one of which is for household use. The three others are for livestock use. This is a scrape-and-haul operation. The site plan for the facility is shown on Figure 2-15.

The site was a farrow-to-finish unit prior to 1992. The site had no animals from 1992 through 1995, at which time the site began operation as a finishing-only facility. Prior to the HPP project, two of the facility barns contained a maximum of 225 hogs, providing the site with a total AU of 66. The barns are cleaned as needed, on average approximately every three days.

Olson uses the feed and antibiotics discussed in Section 2.2.1. Table 2-2 summarizes the site's pharmaceutical use.
2.3.5.2 Post Project Description

No new construction was completed to accommodate HPP hogs. The current facility layout is shown on Figure 2-16. Two of the three barns together currently house an average total of 180-230 finishing hogs. The third barn is currently empty and is not used. All barns are older, naturally ventilated scrape-and-haul facilities. The total AU capacity for the site is approximately 68. The open lots and barns are scraped and cleaned as needed, which currently is approximately every three days. Table 2-1 lists the facility’s general information and Table 2-4 lists barn attributes.

Acreage for land application is depicted on Figure 2-17. According to Olson, since 1998, the volume of solid manure/straw spread has been approximately 50-72 loads per year. The manure was hauled in a 180-bushel manure spreader, at a rate of approximately 415 to 480 cubic yards per year, and spread within his 200 acres. Table 2-5 details manure management practices.

Manure management data obtained from the farrowing and Olson operations indicate that these two facilities have in the past utilized a common field for land application of manure. This field is part of the Olson farm, and is located immediately south of the Olson feedlot site (see Figures 2-5 and 2-17). Available evidence indicates that this has not resulted in overapplication of manure because both have always been required to apply manure at agronomic rates. As required in Minn. R. 7020, if the farrowing site is to continue to use fields on Olson’s farm for manure application, the farrowing site must have the appropriate field and application information within their MMP, perform field and manure testing, and keep the appropriate land application records. Olson should also get a copy of the land application records for his files. For each cropping season, field owners (Olson in this case) should keep manure from different farms separate on land application fields as a best management practice and provide that information to the farrowing site for use in their MMP.

Feed, premixes and medications did not change after the HPP project began. Feed and premixes are discussed in Section 2.2.1 and summarized on Table 2-2.

Olson composts animal mortalities using straw and manure from the barns as bulking material. Olson reported using the required thickness of bulking material to the pile, but also reported vermin and fly problems near and around the compost pile. Table 2-6 details animal mortality management for the facility.

2.3.6 David Paul Feedlot

The Paul site is located in Section 14, T123N, R42W, Horton Township in Stevens County, Minnesota. The site is approximately six miles south of Hancock, Minnesota. Stevens County

2.3.6.1 Pre-Project Description

The site consisted of a storage shed prior to HPP related construction. A 120-foot residential well (UWN 587922) is on-site for household and livestock use. The site is approximately 800 feet from an unnamed wetland. The wetland on the Paul property is classified by the DNR National Wetland Inventory map as a semi-permanent, emergent/open water wetland. The pre-project site characteristics are shown on Figure 2-18.

2.3.6.2 Post-Project Description

The total confinement barn and house were built in 1998. The storage shed houses equipment for the facility operations. The facility’s layout is shown in Figure 2-19. Table 2-4 details barn and storage pit information. The barn currently houses 500 grower/feeder hogs and 500 finishing hogs for an AU total of 300 for the site. Manure storage capacity for the site is approximately 435,000 gallons per year, which translates to 10 months of storage based on theoretical manure production rates. Actual manure production rates from the facility indicate that the facility has approximately 18 months of storage under current management practices. The conservative water use practices at the facility decrease the amount of wash water entering the pit, allowing for longer storage before the ultimate capacity is reached. Gravity perimeter tile drains surround the concrete pit. A sump pump lifts the accumulated water into the discharge pipe that currently drains to a grassy area near the barn. Previously, the tile drainage was directed into the wetland approximately 800 feet away. The perimeter tiles typically drain during wet periods. No water quality testing is performed.

Available acreage for land application totals approximately 630 acres and is depicted on Figure 2-20. Manure management practices are described in Table 2-5. The amount of manure Paul applied to his fields increased from 120,000 gallons in 1998 to 290,000 gallons in 2001.

Feed mixes are the same as those discussed in Section 2.2.1. Table 2-2 summarizes the site's pharmaceutical use.

Paul buried dead animal carcasses at the north end of the yard in the past, but reports that he stopped that practice in the fall of 2001 when a compost pile was started adjacent to the surface water, on the north side of the property. This pile was subsequently removed and dead animals were again buried for a time. The MPCA subsequently advised Paul in 2002 not to bury his animals due to the close proximity of the water table. Currently, Paul reports rendering his animal mortalities as summarized in Table 2-6.
2.3.7  **Stanley Schaefer Feedlot**

The Schaefer site is located in Section 21, T123N, R41W, Moore Township in Stevens County, Minnesota. The site is approximately 4 miles southwest of Hancock, Minnesota. Stevens County issued a Certificate of Compliance (STEV-C 038) for feedlot construction in February 11, 1998, and revised it in May and June of 1998.

2.3.7.1  **Pre-Project Description**

Prior to HPP-related construction, the site consisted of the house, one total confinement barn, one partial confinement barn, and an open lot. The total confinement barn has a concrete floor, using scrape and haul as the manure management method. The site's general characteristics are listed in Table 2-1. The facility's pre-project layout is shown on Figure 2-21. Table 2-4 details barn information before construction of the two new barns for the HPP Project. The storage shed houses equipment for the facility operations. A 90-foot residential well (UWN unknown) located approximately 65 feet from the old barn, is on-site for household and livestock use.

Prior to the HPP project, the site was a nursery with approximately 120 piglets housed in the total confinement barn.

The feed and additives for the hogs do not differ from the general description in Section 2.2.1, except that the facility also uses Lincomycin to treat hog intestinal problems such as dysentery. Table 2-2 summarizes antibiotic use at the feedlot.

2.3.7.2  **Post-Project Description**

Two new total confinement barns were built in 1998. Table 2-4 details barn information. The north barn was built first and initially housed hogs from HPP and other sources. Currently the site only accepts hogs from HPP. Schaefer some time ago informed Stevens County that he was planning to build a third barn having the same dimensions and physical characteristics as the two barns built in 1998, but has since reconsidered. The barns currently house 1000 grower/feeder hogs and 1000 finishing hogs, for a site total of 600 AU. The older barns on the site are used occasionally to house slow growers culled from each shipment, averaging 60 hogs every two months. The manure tonnage hauled from the old barn has reportedly been reduced from 5 tons in 1998 to 0.5 tons in 2001. The facility's layout is illustrated on Figure 2-22.

The MPCA received an additional feedlot application from Schaefer in October 1998 proposing two more barns, in addition to the two new barns he had recently built. The application was later withdrawn in 1999. Schaefer more recently submitted a completed application to Stevens County, with a Manure Management Plan (MMP), for the proposed construction of only one
additional barn for the site. Schaefer subsequently withdrew this latest request. Nonetheless, the analysis considers the effect of a three-barn operation at the Schaefer site, as noted earlier.

Use of the state’s revised 0.3 animal unit conversion factor for finishing swine between 55 pounds and 300 pounds results in a different permit application requirement than if one used the April 14, 2003 US EPA criteria (2500 swine rather than 55 pounds) for CAFOs and Schaefer elects to build the third barn. If the third barn is constructed, Schaefer would have 3000 swine and meet US EPA’s criteria for a definition for CAFO. MPCA would inform Schaefer of the difference between Minnesota’s animal units and EPS’s definition for CAFO and that under federal regulations Schaefer would be required to submit an NPDES permit application before the third barn is constructed. See also Section 2.4.5.3.

Manure management operations are summarized in Table 2-5. Manure storage capacity for the site (including the proposed third barn) is approximately 1.3 million gallons, which translates to 10 months of storage using theoretical manure production rates. Actual manure production rates from the facility indicate that the facility has approximately 17 months of storage. The conservative water use practices at the facility decrease the amount of wash water entering the pit, allowing for longer storage before the ultimate capacity is reached. Available acreage for land application totals approximately 1,345 acres, which is shown on Figure 2-23. Since 1999, manure land application increased from 270,000 gallons to the 2001 total of 606,000 gallons from the current two-barn system.

Feed, premixes, and medications have not changed since the HPP project began. The pharmaceuticals and their uses are discussed in Section 2.2.1. Table 2-2 summarizes the facility's pharmaceutical use.

Schaefer reports operation of a compost site to manage animal mortalities. Schaefer uses only straw as the bulking material. Schaefer indicated that the pile is turned every couple of months and landspread on nearby fields when composting is complete. Table 2-6 summarizes the site's animal mortality management practices.

2.3.8 Jere Solvie Feedlot

The Solvie site is located in Section 5, T124N, R40W, Walden Township in Pope County, Minnesota. The site is approximately six miles northeast of Hancock, Minnesota. A Certificate of Compliance (MPCA-C 6895) was issued to Solvie for construction of one new barn with an underbarn concrete pit. In addition, certification of the pre-existing clay basin was included in the Certificate of Compliance. A revised Certificate of Compliance (MPCA-C 6895R) was issued in June of 1998.
2.3.8.1 Pre Project Description

The pre-project site layout is shown on Figure 2-24. Prior to HPP-related construction, the site consisted of the house, one total confinement barn built in 1994, a 1 million gallon earthen basin to which it drained, and an older scrape and haul barn approximately 45 years old. General facility information is listed on Table 2-1. Two wells, one approximately 45 feet deep (UWN 577133), and another of unknown depth (UWN unknown), are on-site for household and livestock use.

Prior to the HPP project, the site typically had approximately 250 grower/feeder hogs and 500 finishing hogs in the total confinement barn. The old barn sometimes housed hogs culled from the total containment barn. The total AU for the site was 225.

The feed and additives used at the site are discussed in Section 2.2.1. Table 2-2 summarizes the facility's pharmaceutical use.

2.3.8.2 Post-Project Description

The post-project layout of the site is shown on Figure 2-25. The pre-Hancock total confinement barn is still in use along with the existing earthen basin. One new total confinement barn was built for HPP hogs in 1998 with an 8-foot deep concrete storage pit. Gravity drain tile is installed and discharges at a wooded area near the barns. The site's barn summary is given in Table 2-4. Currently, the site accepts hogs from HPP and other sources. The barn built in 1994 houses approximately 750 non-Hancock hogs. The new total confinement barn houses 1000 HPP hogs (300 AU). This is the current HPP total. The barns together house a total of 1750 grower/feeder hogs and finishing hogs. The total AU--Hancock plus non-Hancock--for the site is 525.

Manure management practices are detailed in Table 2-5. Manure from the 1994 non-Hancock barn drains to the earthen storage basin. The earthen basin and the concrete pit under the HPP barn are emptied once a year, not necessarily at the same time, and the liquid manure is applied on fields owned or rented by Solvie. The manure from the HPP and non-HPP sources are mixed when pumped and land applied on fields. Manure storage capacity for the site is approximately 1.45 million gallons, which translates to 18 months of storage using theoretical manure production rates. Actual manure production rates from the facility indicate that the facility has approximately 19 months of storage under current management practices.

Available acreage for land application of liquid manure is approximately 1040 acres and is shown on Figure 2-26. Solvie reports that approximately 900,000 gallons have been land applied every year since 1998. The manure is incorporated within 24 hours.
Discussion of use and dosage of the pharmaceuticals is included in Section 2.2.1 and summarized in Table 2-2.

Animal mortality management for the site is summarized in Table 2-6. Solvie has composted and buried mortalities in the past, but now reportedly uses a rendering service for mortality management.

2.3.9 Chad Solvie

Chad Solvie is a shareholder in the HPP project. He obtains 1000 hogs three times a year. Chad Solvie does not have a feedlot to finish his hogs. He sells his shares on the open market.

2.3.10 Wayne Spohr Feedlot

The Spohr site is located in Section 36, T123N, R42W, Horton Township in Stevens County, Minnesota. The site is approximately 8 miles southwest of Hancock, Minnesota. Stevens County issued a Certificate of Compliance (STEV-C 042) for the site on March 3, 1998, and revised it in March and June of 1998.

2.3.10.1 Pre-Project Description

Prior to HPP related construction, the site consisted of the house, two total confinement barns with concrete floors, one partial confinement barn, and one earthen manure storage basin. The earthen basin was included in the Certificate of Compliance indicating the basin was certified by Stevens County. One residential well (UWN unknown), between 75 and 100 feet deep, is on-site for household and livestock use. The pre-project facility layout is shown on Figure 2-27.

Prior to the HPP project, approximately 550 grower/finisher hogs were housed in the two total confinement barns. The site also housed 200 broiler chickens and five horses. The total AU capacity for the site was 176. The general site characteristics are listed in Table 2-1.

No records were kept of manure storage and land application prior to the HPP project.

The feed, additives, and antibiotics are the same as those discussed in Section 2.2.1 with the additional usage of injectable penicillin for control of erysipelas, an irritating skin infection.

2.3.10.2 Post Project Description

The manure storage basin was closed and a new 1000-hog total confinement barn was built in the former earthen storage basin in 1998 to house HPP hogs. A contractor excavated the earthen storage basin, and the clay and manure removed from the basin were placed in manure spreaders and landspread on fields owned or leased by Spohr. The new barn with an eight-foot deep concrete pit beneath it was then built in the excavation. The facility's barn summary is included
in Table 2-4. Currently the site only accepts hogs from HPP. Spohr continues to maintain chickens and horses on-site. The barns currently house 1,550 grower/feeder hogs and finishing hogs (550 of which are housed in the old barns), 150 chickens, and 6 horses. The new HPP capacity is 300 AU and an additional 165 HPP AU are housed in two older barns. With the horses and chickens, the total AU capacity for the site is 477. The site plan for the facility is shown on Figure 2-28.

Manure management practices are summarized in Table 2-5. The floor of the new barn is partially slatted, and drains to the concrete pit beneath. The pit is pumped once a year and the liquid manure is landspread on portions of the available 1000 acres of fields. Manure storage capacity for the barn is approximately 477,190 gallons, which translates to approximately 9 months of storage using theoretical manure production rates. Under current management practices facility has approximately 18 months of storage. The conservative water use practices at the facility decrease the amount of wash water entering the pit and allow for longer storage before the ultimate capacity is reached.

Manure from the concrete floors in the other barns is scraped periodically and directly applied to land application acres. The manure is landspread and incorporated within 24 hours. Spohr has been scraping and hauling approximately 152 tons of manure (12.7 tons/month), and has applied a range of approximately 240,000 to 296,000 gallons of liquid manure, every year since 1999.

The identified manure land application sites for the facility are shown on Figure 2-29 and is summarized in Table 2-5.

Feed, premixes, and medications are the same as those discussed in Section 2.2.1 with additional use of injectable penicillin. The pharmaceutical use and dosage data is summarized in Table 2-2.

The composting site is on the south side of the pre-existing barn on a concrete open lot. Mortality management practices are summarized in Table 2-6. Spohr uses a straw/manure mixture as the bulking material and turns the pile with a skid loader when it steams. The finished material is applied to adjacent fields.

2.3.11 Craig Swenson

Craig Swenson's share of the HPP project consists of 1000 hogs, three times a year. Swenson does not have a feedlot to finish his hogs. He sells his share on the open market.

2.3.12 John Zeltwanger Feedlot

The Zeltwanger site is located in Section 1, T123N, R41W, Moore Township in Stevens County, Minnesota. The site is slightly over one mile east of Hancock, Minnesota. Zeltwanger
completed a permit application in 1997. However, no new construction was proposed by Zeltwanger for the HPP project, and it had no documented pollution hazard. Therefore, a Certificate of Compliance was not issued since they were not required for facilities without documented pollution hazards or new construction.

2.3.12.1 Pre-Project Description

Prior to the HPP project, the site consisted of a house, a Quonset, two total confinement barns, one partial confinement barn, and a lean-to structure. The barns on site house 600 hogs, for a an AU of 180. A machine shed is at the site for equipment storage. The general site characteristics are summarized in Table 2-1, and barn attributes are given in Table 2-4. Two wells, UWN 450069 and 541890, are on-site for household and livestock use (70' and 100' feet deep). One well is 70 feet south of the machine shed and the second well is located in the northwest corner of the barn. The site's barn summary is in Table 2-4. The site plan for the facility is shown on Figure 2-30.

Zeltwanger hauled approximately four loads of manure/straw (scraped from the barn floors) in an eight-ton manure spreader per week (on average) and landspread it throughout the 692 acres available. The locations of the manure land application sites are shown on Figure 2-32. Land application practices are summarized in Table 2-5. Zeltwanger spreads manure year round. However, if fields are unsuitable for land application of manure, due to excessive snow cover or frozen soil, he temporarily stockpiles the manure before spreading it. An old concrete platform on the feedlot is used for temporary stockpiling. Once conditions allow for land application of manure, Zeltwanger removes all manure from the stockpile site and spreads it in his fields.

The antibiotics Tylan®, Aureomycin® and injectable penicillin are used at the Zeltwanger feedlot, in addition to injectable Excenel® (for treatment of swine bacterial respiratory disease) and Lincomycin (for hog dysentery and ileitis). Discussion of use and dosage of the pharmaceuticals is included in Section 2.2.1 and summarized in Table 2-2.

2.3.12.2 Post Project Description

No construction was completed for the HPP project. A site plan of the current facility is shown in Figure 2-31. Two of the three barns currently house 600 finishing hogs. The remaining barn and attached lean-to are reportedly empty and are intermittently used to house hogs culled from the primary barns. The total AU for the site is 180. The barns are scraped and cleaned as needed, which is approximately once per week.

Zeltwanger reports that he has not changed his land application practices from pre-project operations discussed in Section 2.3.12.1. However, Zeltwanger does not have records for the acreage that he has spread for the last four years.
Feed, premixes and medications do not differ from pre-HPP project practices discussed in Section 2.1.13.1.

The Zeltwanger site uses a rendering service to pick up mortalities as necessary.

Zeltwanger has recently put his HPP hog share on the market. His operation may cease operating as a HPP feedlot site.

2.4 PERTINENT LAWS AND REGULATIONS

2.4.1 Air Quality Standards and Inhalation Health Risk Values

The emissions from feedlots must comply with the Minnesota Ambient Air Quality Standards (Minn. R. 7009.0080) and should not exceed the inhalation Health Risk Values (iHRVs) developed by the Minnesota Department of Health (Minn. R. 4717.8000). A feedlot must comply with the ambient air quality standards at its property lines or at the property lines for an adjoining parcel of land whose owner has granted an air quality easement to the feedlot (MN Stat. 116.0713). Feedlots are exempt from the ambient air quality standards while manure is being agitated and for seven days after manure is removed from barns or manure storage facilities. Feedlots with more than 300 AU are limited to 21 total days of exemption in a 12-month period. Feedlots that claim temporary exemption from the state ambient air quality standards during manure removal must provide prior notice to the MPCA or the County (Minn. Stat.116.0713).

Minnesota has two ambient air quality standards for hydrogen sulfide. The first standard provides that the one-half hour time-averaged hydrogen sulfide concentration of 30 ppb by volume (42 µg/m³) shall not be exceeded more than twice in any 5 consecutive days. The second standard is that the one-half hour time-averaged hydrogen sulfide concentration of 50 ppb by volume (70 µg/m³) shall not be exceeded more than twice per year. The Minnesota ambient air quality standards are designed to protect public health and welfare from adverse effects or anticipated adverse effects. Adverse effects include subjective and physiological symptoms that are likely to interfere with normal activity in healthy or sensitive individuals. Adverse effects also include those symptoms and physiological changes that are likely to interfere unreasonably with the enjoyment of life and property (Minn. R. 7009.0010). The 30-ppb standard, which was promulgated in 1969, corresponds with the annoyance threshold concentration for hydrogen sulfide based on the scientific literature available in the late 1960s. More recent research suggests that hydrogen sulfide concentrations less than or equal to 30 ppb should protect the public from the physiological symptoms of headache and nausea.

If a feedlot’s emissions exceed the ambient air quality standards, the MPCA may initiate enforcement actions, which may result in monetary penalties, the requirement of corrective actions, or both (MPCA 1999). Each enforcement action is decided on a case-by-case basis to determine monetary penalty and corrective action requirements. If air quality complaints are
lodged with the MPCA, the complaint is referred to the appropriate MPCA regional staff, who is responsible for follow-up of the complaint.

The inhalation Health Risk Values (iHRVs) developed by the Minnesota Department of Health (MDH) are air-phase chemical concentrations below which a significant health risk to humans exposed to those concentrations for the specified time (hourly, 13-week, or annual) is not expected to occur. Moreover, because of the MDH’s conservative approach in developing the iHRVs, exposure to chemical concentrations above the iHRV does not necessarily pose a human health risk. Public health refers to the protection of the most sensitive portions of the population, which includes children, pregnant women and their fetuses, individuals compromised by pre-existing diseases, and elderly persons. However, iHRVs may not be protective of every individual, e.g., hypersensitive individuals who may respond unpredictably to chemical exposures.

State rules and statutes do not specify how the iHRVs should be used. MDH and MPCA use the iHRVs to assist in the assessment of potential human health risks associated with atmospheric chemical exposure. The iHRVs are used as an assessment tool in the environmental review process, issuing of air permits, and risk assessments. State statutes do not provide feedlots with the ability to claim an exemption from the iHRVs during manure removal.

The MDH has developed one iHRV for hydrogen sulfide and two iHRVs for ammonia. The subchronic (13-week time-averaged) iHRV for hydrogen sulfide is 10 µg/m³ or 7 ppb by volume (Minn. R. 4717.8150). The acute (hourly) iHRV for ammonia is 3200 µg/m³ (Minn. R. 4717.8200) and the chronic (annual time-averaged) ammonia iHRV is 80 µg/m³ (Minn. R. 4717.8100).

2.4.2 Certificate of Compliance

A Certificate of Compliance was a written statement from the regulatory authority that a feedlot was in compliance with state requirements as of the date of issuance. At first, all Certificates of Compliance were issued by MPCA. When the Delegated County program was initiated, counties took over issuance for certain types of feedlots. Certificates of Compliance are no longer used in the feedlot regulatory program, since the new feedlot rules were adopted.

Certificates of Compliance were administered and issued by Stevens County for the HPP sites located in Stevens County. Since Pope County was not delegated, MPCA issued the Certificates of Compliance for the two sites in Pope County.

Certificates of Compliance were issued to all but the Olson and Zeltwanger finishing feedlots within the HPP Project. Certificates of Compliance were not issued for these two sites because the Zeltwanger and Olson feedlots were not being modified, and they had no known pollution hazards.
The Certificate of Compliance contained standard management or construction practices at each facility to maintain compliance, including record keeping on the manure management practices, Board of Animal Health (BAH) rules regarding dead animal disposal, and concrete pit construction criteria. Each facility may have had additional management practices outlined in the Certificate of Compliance, such as restrictions on land application of manure on granular soils, that established how compliance with applicable rules was maintained. Four finishing site operators, Solvie, Olson, Nohl and Schaefer, were specifically identified as having granular soils in their fields. These feedlot owners could only apply manure to these fields between April 15 and July 15 in order to maintain compliance with Minn. R. 7020 and 7060, according to their Certificates of Compliance. Table 2-7 summarizes the Certificate of Compliance provisions.

Although certificates of compliance are no longer issued now that the MPCA feedlot rules have been revised, a comparison of practices listed in the certificates with current feedlot operations provides some insight into a particular feedlot’s potential compliance with current MPCA requirements and conformance with accepted agricultural pollution prevention practices. For the purposes of the EIS, MPCA staff conducted a review of the operations of the several Hancock finishing facilities that were previously issued certificates. Of particular interest was the best management practice to avoid fall application of manure on granular soils. Those reviews are discussed in Section 6.0.

2.4.3 Finishing Site Initial Requirements

Plans and specifications for the barns built at the Stevens County finishing sites were submitted to Stevens County. Operators for the two sites located in Pope County, Solvie and Greiner, submitted manure management plans to the MPCA, since Pope County was not a delegated county at that time. Issuance of Certificates of Compliance to the expanding sites indicated approval of those plans by Stevens County or the MPCA.

2.4.4 Farrowing Facility Initial Requirements

In order to construct and operate the farrowing facility, HPP obtained the following permits in 1998:

- Conditional Use Permit (CUP) from Stevens County
- MPCA Interim Permit
- NPDES General Storm Water Permit for Construction and Erosion Control

The Conditional Use Permit (CUP) for the farrowing facility included requirements for land application setbacks and use of odor control when necessary. See Appendix B for a copy of the Stevens County CUP.
An Interim Permit application was submitted to the MPCA that included a Manure Management Plan (MMP), an Air Emissions Plan, an Emergency Response Plan, and construction plans for all the barns. After the EAW process was completed, the farrowing facility was issued an Interim Permit (MPCA-I 2358(A)) in February 1998, with special conditions concerning construction, construction approvals, manure management, manure sampling, manure analysis, and air emissions monitoring. The Interim Permit included conditions for land application setbacks near sensitive features, limiting manure land application on granular soils between April 15 and July 15, manure-testing requirements, air monitoring requirements, and record keeping. A copy of the Interim Permit is included in Appendix B. The Interim Permit expired December 13, 1998.

The Interim Permit set specific construction and certification requirements. Construction certification reports were required of manure storage structures with capacities greater than 500,000 gallons. The farrowing and nursery barn pit volumes were beneath that threshold. However, construction certification reports were required of the three gestation barns. The farrowing facility was inspected by the MPCA throughout its construction.

HPP also obtained coverage for the farrowing facility under the General NPDES Permit for Storm Water Discharge During Construction (MN R10000, expiration date of September 3, 1998). Requirements set in this permit were to reduce the amount of sediment/pollution entering surface waters both during and after construction projects.

2.4.5 Revised Feedlot Rule Requirements

2.4.5.1 General Facility Requirements

The Minnesota feedlot rules (Minn. R. ch. 7020) were extensively revised on October 23, 2000. All feedlots must comply with the new rules as applicable.

2.4.5.2 Current Farrowing Facility Requirements

Under the revised feedlot rules, the farrowing site was required to register with Stevens County.

The Interim Permit expired in 1998. Because permits cannot be issued until environmental review is completed, the MPCA has not issued a new permit. However, the farrowing facility is required in the meantime to follow the revised feedlot rules and the conditions established in the Interim Permit.

2.4.5.3 Final EPA Rules Regulating Livestock Wastes

On December 16, 2002, the Environmental Protection Agency (EPA) announced final rules for regulating livestock waste runoff from agricultural feeding operations. The new rules may impact the HPP project in the future. In Minnesota, MPCA is the state NPDES permitting

Apr 03 Hancock Pro-Pork EIS • Page 33 •
authority that implements the federal NPDES program. The revised feedlot rule (Minn. R. ch. 7020) is the primary rule governing feedlots in Minnesota. At present, MPCA is authorized to implement the NPDES program using the revised feedlot rule. Therefore, all feedlots with more than 1000 animal units are required to obtain an NPDES permit in Minnesota.

2.4.6 Animal Mortality Management Requirements

Feedlots routinely experience some mortality loss, and must manage the dead animals in a way that protects the health of other domestic animals and minimizes adverse effects on human health and the environment. Table 2-8 summarizes the expectations for animal mortality management established by the state Board of Animal Health (BAH) and the MPCA. The BAH has rules (Minn. R. ch. 1719) governing mortality composting operations, rendering service pickup and storage areas, and cover depth on burial pits. The MPCA makes recommendations for the separation distance between burial pits and the water table, and has established requirements for carcass incineration (Minn. R. Ch. 7011.1215).

2.4.6.1 BAH Program

General Requirements
The BAH mortality management program is codified in Minn. Stat. sec. 35 and Minn. R. ch. 1719. The following guidelines are generally applicable to feedlot mortality management. For further detail, refer to Table 2-8.

- Carcasses must be disposed of as soon as reasonably possible, i.e. within 48-72 hours.
- No permit is required for a person to haul the carcass of an animal that was owned by that person before the animal died.
- Persons hauling carcasses or discarded animal parts for disposal (e.g., anyone who moves a dead animal from a feedlot to a compost pile or rendering truck pickup point) must keep the carcasses or discarded animal parts completely covered, in a leak proof container or truck body while transferring the material over any public road.
- Any off-site (meaning away from the feedlot) pickup point must be an animal proof, enclosed area that is at least 200 yards away from any neighbor's buildings, and carcasses must generally be picked up within 72 hours.

Rendering

Several of the HPP sites have their mortalities picked up by rendering companies as a means of managing their death loss. BAH recommends that the mortalities be kept “off-site”--that is, away from the feedlot proper--as a biosecurity measure. Mortalities should be picked up no more than 72 hours later unless refrigerated, in which case seven days is acceptable.
The time period requirements for rendering service pick-up of a carcass are specifically for off-site pick up sites. None of the finishing sites store dead animals for pickup off-site, although the farrowing facility maintains a dead animal freezer for this purpose across the road from the site.

**Burial**

Minnesota Statutes 35.82 requires that enough soil cover must be used to keep scavengers out. BAH guidelines indicate that three feet is sufficient. No HPP members are currently using burial for mortality management, although some have in the past.

**Composting**

Several of the HPP finishing sites use this method for mortality disposal. The BAH rules govern construction and operation of the compost piles, and provide specific management guidance to assure successful operation. According to BAH, successful composting requires an impervious pad of some type under the pile, a bulking agent/carbon source, adequate moisture, and periodic turning of the pile. Although manure has some drawbacks as a bulking agent, it is readily accessible to operators, and it is acceptable under the program. The HPP members who compost tend to use manure more than other bulking materials, although Schaefer uses more straw and cornstalks than manure. Properly managed, composting is a convenient and environmentally friendly method of mortality management.

**Enforcement of BAH Regulations For Dead Animal Disposal**

The BAH mortality management program is primarily complaint driven; ninety percent of BAH mortality management inspections occur as the result of complaints. The remainder is requested by site operators or other regulatory agencies. When complaints are brought against a farm or facility, one of three BAH inspectors visits the site to determine if the site is compliant.

When an inspector arrives at a site, the inspector uses his/her professional judgement and experience to determine the site is in general compliance with BAH requirements. If the practice is composting, the BAH inspector then reviews the practices used at the site including location of compost pile on an impervious pad (compacted soil, clay or concrete pad); use of adequate bulking, litter, and cover material; and general compliance with the requirements listed in Table 2-8. The inspector then determines if the site is compliant, operating deficiently, or is non-compliant. Compliant sites meet all the requirements observed and asked for by the BAH inspector. Sites that are judged as deficient operations are advised on how to fix the problems, i.e. adding more cover to make sure the animal parts are covered.

If the site is determined to be non-compliant, the inspector reviews the BAH regulations with the operator, orders changes, and suggests options that will achieve better operation of the site’s mortality management in accordance with the regulations. The operator is given a period of time to comply with the changes required by the BAH inspector. The BAH inspector returns to the
site after the prescribed time period has passed to ensure changes were made. If a site's mortality is still not managed correctly, the BAH inspector may levy fines against the operator, dependent on the severity and frequency of the infraction(s). Civil or criminal enforcement actions may also be carried out as the individual case warrants.

For composting, consultation with BAH regulators and inspectors indicate that daily temperature monitoring is required in the rules, but is used primarily as a tool specifically for operators new to composting, in order to assist them in composting correctly (e.g. knowing when to turn the pile between heat cycles). Although temperature monitoring is required in the rules, BAH inspectors do not typically ask to see temperature logs if in their judgment the pile is operating correctly.

The rules require that each composting facility have a written protocol of composting procedures. However, individual feedlots, such as the HPP finishing sites, may use the BAH composting rules as their written protocol. Large feedlots with satellite operations under one ownership (HPP finishing sites are individually owned and operated) are required to have their written protocol posted at all sites to ensure proper operation of the compost piles. If in his judgment the compost pile is being operated correctly, the BAH inspector does not typically ask to see a written protocol.

2.4.6.2 MPCA Program

**Incineration**

The MPCA regulations that govern emissions from waste incinerators are found in Minn. R. 7011.1215. Only the farrowing facility incinerates, and is therefore subject to these requirements. Incinerators that are used solely for the disposal of animal carcasses are required to follow subpart 3 of these rules, which requires that emissions from the incinerator not exceed 20% opacity and have an operating afterburner that maintains flue gases at 1,200 °F for at least 0.3 seconds. Transported or stored ash must be handled in such a manner as to prevent particulate matter from becoming airborne.

**Burial**

Minn. Stat. 35.82, subd. 2 (the BAH program) states that a dead animal shall be buried as soon as reasonably possible at a depth adequate to prevent scavenging by other animals. The MPCA recommends that dead animal burial be at least five feet above the water table. The recommended distance from the water table is based on the industrial solid waste rule MN Rule 7035.1700, adopted by the MPCA for burial of industrial solid waste.

**Manure Composting and Stockpiling**

Composting is becoming more widely used as a method for mortality disposal. In light of this, it is important to be clear when the composting process is subject to the state feedlot rules (chapter
and when it is subject to the Board of Animal Health regulations (chapter 1719). Both regulations aim to ensure that the composting process is performed in an environmentally sound manner.

MPCA administers rules (in Minn. R. ch. 7020) that govern the process of composting manure. If a compost pile is being managed for this purpose, those rules apply, and MPCA regulates compliance. BAH, on the other hand, regulates (via Minn. R. ch. 1719) compost piles whose aim is to manage animal mortalities. This is an issue because the HPP compost piles are animal mortality compost piles, but they also contain manure used as a bulking agent.

Manure is considered a component of the mortality disposal system when it is used as a bulking agent/carbon source as part of the composting process. Manure also adds some moisture, nitrogen, and microorganisms. But, when manure is used in this way as an aid to the mortality composting process, MPCA considers the process to be one of animal mortality composting that is regulated by BAH. The MPCA manure composting rules do not apply in these circumstances. In such a case, MPCA recommends as a best management practice that the setbacks and location requirements outlined in 7020.2125, Subpart 2.C & D and Subpart 4.C be followed for mortality compost sites, but recognizes that the purpose is to compost mortalities, not manure. Composting systems that compost mortalities are considered mortality management systems and are governed by the Board of Animal Health program.

On the other hand, compost systems that manage the manure (rather than the mortalities) generated at a facility are considered manure management systems and are governed by the MPCA’s feedlot rules. None of the HPP facilities manage manure by composting. The composting systems owned and operated by HPP are considered to be animal mortality compost systems regulated by the Board of Animal Health regulations, and compliance status of these systems is determined by Board of Animal Health staff.
3.0 ENVIRONMENTAL SETTING

This section of the EIS reviews the general environmental setting of the three-county area within which the project is located and a more detailed review of the environmental setting at each of the facilities of the project. The regional environmental setting description will characterize the area-wide characteristics of the following: air quality, geology and soils, hydrogeology and hydrology, ecology, public health, and socioeconomic conditions. The detailed environmental setting will review similar characteristics, but will focus on the more detailed situation at each site.

3.1 REGIONAL AIR QUALITY

3.1.1 Climatology of Area

Pope, Stevens, and Swift Counties have a mid-continental climate characterized by warm, moist summers and cold, dry winters. These counties lie in an area of considerable interaction between cold, dry Canadian air and warm, moist Gulf air, which can result in marked daily weather changes. The monthly averages for temperature and precipitation were collected at the Benson weather station (MN0667) for the period 1961-1990 and runoff from the Pomme De Terre River at Appleton (0529400) for the period 1931-1999. The weather station at Benson, Minnesota was used because it provided detailed temperature and precipitation data for the area.

The climate is generally uniform throughout the three county area with some variability in the temperatures and summer precipitation. On calm, clear nights, the temperature in low-lying areas is a few degrees lower than in other areas. Rainfall from showers during the warm months varies considerably from place to place, though seasonal totals are similar.

Temperature

The annual average temperature is 44 degrees Fahrenheit (F) with an annual average daily maximum temperature of 54 degrees F and an annual average daily minimum temperature of 33 degrees F. The extreme maximum and minimum temperatures for the period of record are 104 degrees F and –35 degrees F, respectively. During the winter, the average temperature at Benson is 14 degrees F and the average daily minimum temperature is 5 degrees F. In the summer, the average daily temperature is 70 degrees F and the average daily maximum temperature is 82 degrees F.

Precipitation

The average annual precipitation at Benson for the period of record is 27.39 inches of water, including melted snow. For the months of May through September, the average rainfall is 17.1 inches or 62% of the annual precipitation. The heaviest 1-day rainfall for the period of record, 5.57 inches, occurred on August 18, 1990. Most thunderstorms occur from May through August, with an average annual total of 35 days. The average seasonal snowfall depth for the period of
record is 43.0 inches. The greatest daily snow depth at any time during the period of record was 27 inches, occurring on February 22, 1969. On average, at least one inch of snow covers the ground for 100 days each year. The greatest one-day snowfall for the period of record was 18.7 inches, occurring on March 3, 1985.

**Stream Flow**
The Pomme de Terre River at Appleton discharges 2.05 inches of runoff and ground water discharge base flow from the 905 square miles of the watershed. Average monthly runoff is 0.10 inches of water or less for the period of August through February. March and April see the greatest runoff into the river at 0.41 and 0.50 inches respectively, as a result of melting snow and rainfall over frozen and saturated ground.

**Wind**
Rolling and flat terrain dominate the landforms of the three county area. Open fields with few windbreaks, farmstead groves, or towns provide little surface resistance to winds at the ground surface for most of the year. Speed and direction are mostly a function of weather fronts, altitude, and the diurnal cycle.

The three nearest sources of historic wind data include Fargo, Redwood Falls, and St. Cloud. The wind direction for the winter months is consistently from the north to northwest. The late spring, summer, and early fall months see the dominant winds coming from the south and southeast for each of the three stations.

On an annual basis, winds are predominantly from the south-southeast at a speed of 12 mph at Fargo. Winds are generally from the west at 11 mph on an annual basis at Redwood Falls. The City of St. Cloud typically has winds from the north at 8 mph on an annual basis.

### 3.1.2 Ambient Air Quality

The MPCA installed a continuous air monitor (CAM) and meteorological station at the farrowing/nursery site from July 28, 1999 to October 10, 2000. The equipment collected air quality data as well as wind speed and direction. This information was used for the modeling of air emissions from the facility in the EIS.

Ambient (or background) air conditions in the area of the project were characterized by means of guidance and protocols developed by EPA and MPCA. Background (non-project) levels of hydrogen sulfide and ammonia were calculated based on measured concentrations from the HPP farrowing site as well as other feedlots elsewhere in the state.

The MPCA installed a meteorological station and CAMs at the Hancock farrowing site to simultaneously record wind speed, wind direction, hydrogen sulfide concentration, and ammonia concentration. The wind direction information allowed a determination of whether the recorded
hydrogen sulfide and ammonia concentrations originated from the farrowing site or from off-site sources. The concentrations occurring when winds were not blowing from the farrowing site towards the monitors provide a measure of background concentrations, i.e., concentrations due to other sources such as wetlands, other feedlots, and industrial sources (although in this case there are no industrial sources near the Hancock farrowing site). The background concentrations estimated from the monitoring data are considered applicable within a distance of about 3 miles from the site, so they apply to the Schaefer and Nohl sites as well.

The monitored hydrogen sulfide concentrations for off-site sources ranged from 0 to 111 ppb. In air dispersion modeling studies to determine compliance with an ambient air quality standard, U.S. Environmental Protection Agency modeling guidance (40 CFR 51, Appendix W) states that a background concentration taken from air quality monitoring data should be added to the model-predicted concentrations to account for pollution sources that were not specifically modeled. The estimated background concentration should be taken from ambient air quality monitoring data that is not influenced by the source or sources that will be directly modeled. In addition, the background concentration should conform to the format of the particular standard. For example, if the standard under consideration is an annual average concentration, then the annual average concentration from representative monitoring data should be taken as the background concentration.

The Minnesota H\textsubscript{2}S ambient air quality standard has a more complicated format. The 0.05 ppm (50 ppb) standard is a one-half hour average not to be exceeded more than twice per year. Starting with representative air monitoring data, the appropriate H\textsubscript{2}S background concentration for this standard would be the third highest (allowing two exceedances) one-half hour average recorded over one year of monitoring.

The 0.03 ppm (30 ppb) standard is a one-half hour average not to be exceeded more than twice in any five consecutive days. To find the appropriate H\textsubscript{2}S background concentration for this standard involved reviewing every five-day period of monitoring data and selecting the third-highest concentration during the period. This “highest third-highest” concentration would then be the appropriate background value.

The third highest non-site hydrogen sulfide concentration, 32 ppb, is used in this EIS as the background concentration for the 50-ppb hydrogen sulfide standard for the purpose of assessing air impact in **Section 4.1**. The third highest concentration in any 5 consecutive days was 21 ppb, which is used as the background concentration for the 30-ppb standard. The 13-week time-averaged non-site hydrogen sulfide concentration for the first 13-weeks of monitoring was 0.7 ppb, which is used as the background concentration for the subchronic hydrogen sulfide iHRV. These background values are used in this EIS because they are actual, measured numbers from the CAM.
Since there is no monitored hydrogen sulfide data from the remainder of the HPP sites, agency guidance calls for use of statewide average background values that were calculated based on monitored data from a number of other sites in Minnesota. Thus, for the Solvie, Greiner, Olson, Charles, Paul, and Zeltwanger sites, the hydrogen sulfide background numbers used in this EIS are 17 ppb for the five-day standard and 18 ppb for the annual standard.

Background values for ammonia that are used for all sites in this EIS are limited to the measured concentrations recorded by the CAM at the farrowing site. Controlled surveillance of ammonia concentrations has not been performed at any other sites in the state, so no statewide average for background ammonia can be calculated. The monitored (at the farrowing site) ammonia concentrations for off-site sources ranged from 0 to 148 µg/m3. The maximum observed off-site ammonia concentration (148 µg/m3) was used as the background concentration for the acute ammonia iHRV. The annual average off-site ammonia concentration was 5.72 µg/m3, which was used as the background concentration for the chronic ammonia iHRV.

### 3.1.3 Existing Land Use and Odor Sources

The HPP project is located in an area that is zoned agricultural. Three of the ten sites include new construction at an existing operation. Five of the operations include construction on property with no pre-existing hog operation (this includes Alan Charles, who has not actually built his HPP facility to date).

There are no schools, parks, churches, cemeteries, or other public access facilities within one mile of any of the HPP feedlots, except that the Charles barn, if built, would be within one mile of the city of Hancock. The only public structures or facilities near any of the sites are public roadways.

There are numerous pre-existing odor sources in the HPP project area (see Figure 3-1), some of which are feedlot operations. Gantzer Environmental utilized these odor sources in the regional odor assessment that is part of the air-modeling component of the EIS.

### 3.2 Regional Geology/Soils

#### 3.2.1 Bedrock

The area of the project is described by Sims (1970) as being underlain primarily by undifferentiated gneisses and schists. The gneisses have mineral assemblages characteristic of the upper amphibolite and granulite metamorphic facies. The early geologic history of these gneisses has largely been obliterated by metamorphism and emplacement of granitic rocks about 2,650 million years ago.
Rocks of the Cretaceous age are nearly continuous beneath a thick cover of Pleistocene material throughout the western half of the state. The rocks consist of a weathering-residuum and overlying clastic strata, and lie unconformably on a surface consisting of rocks ranging in age from Precambrian to Devonian. Deep weathering of the gneisses formed a regolith, commonly about 100 feet thick, part of which was reworked to form Cretaceous deposits of sandstone and shale. These sedimentary formations were then eroded, in some areas completely eroded, during a significant period of gliation in the Pleistocene epoch.

The bedrock hydrogeologic units existing under or near the HPP project area include formations of both the Precambrian and Cretaceous eras. The Precambrian units are not considered an aquifer, except locally in faults and fractures. The Geologic Map of Minnesota (Morey and Meints 2000) identifies faults encroaching on the HPP project area as shown on Figure 3-2.

Recent delineations of the extent of the Cretaceous aquifer suggest that intact remnants of the Cretaceous era formations exist in southern Stevens County, thereby possibly encroaching on the HPP project area (Morey and Meints 2000, Austin 1972). A review of the April, 2001 County Well Index, as published by the Minnesota Geological Survey and the Minnesota Department of Health revealed a well in the project area logged by the USGS, which recorded sandstone at a depth of 301 to 302 feet below ground surface (bgs), (depth of well was recorded as 302 feet bgs). This well (UWN 216970) occurs at the extreme northeast extent of the HPP project area, which is overlain by the Alexandria Moraine (See Figure 3-3a). The existence of this Cretaceous-associated deposit may be attributed to the Alexandria Moraine, as the latter may have protected the remaining Cretaceous bedrock from the erosive forces of later glacial events.

However, the logs from two wells (UWN 188306 and UWN 255624) located 2.5 miles southeast of UWN 216970 show hard, mafic-type rock at 200 and 225 feet bgs, respectively, with no mention of an overlying cretaceous deposit. Moreover, no wells containing waters of Cretaceous Age were identified in the aquifers beneath the HPP project area. Unfortunately, potentiometric contours were not published by the United States Geological Survey (USGS) for Chippewa, Swift, Stevens, Pope or Stearns County in the Regional Hydrologic Investigations Atlas (Kanivetsky 1978). Therefore, it is impossible to be certain whether the Cretaceous aquifer extends into the HPP project area as it is illustrated on Figure 3-2.

In general, the bedrock is overlain by 200-400 feet of Quaternary deposits and is not utilized as a water source in West Central Minnesota. The USGS Hydrologic Atlas Series (Morey and Meints 2000) for the region further refers to these Quaternary deposits as consisting of several aquifers, which are the uppermost, and arguably the only, resource aquifers in the area. The bedrock in this vicinity may thus not contain aquifers, is not utilized as such even if it does and is far enough from the surface (under a number of confining layers) so that the possibility of
impacts on it from the HPP project is extremely remote. It is therefore not addressed further in this EIS.

### 3.2.2 Quaternary Deposits

Land utilized by Hancock Pro Pork facilities is underlain by glacial drift approximately 200 to 400 feet thick (Grant 1972, Kanivetsky 1978). These deposits consist primarily of glacial till and outwash sands and gravels. The glacial drift includes ground moraines and outwash sands undivided as to moraine association. Glacial till in this location generally consists of gray calcareous material, including shale and limestone clasts with silt and clay. The topography of the areas in which till is present at the surface is generally rolling and irregular, and may be dominated by cohesive (clayey) soils. Glacial outwash areas, on the other hand, are nearly flat to gently rolling, and are usually characterized by granular (sandy or gravelly) soils. The Quaternary deposits of the Hancock Pro Pork facilities are shown on Figure 3-3.

Granular outwash deposits are located near the Pomme de Terre and Chippewa Rivers and in a broader outwash area located in south-central portion of the HPP project area (Wright 1972). Glacial melt-water stream positions and rates of discharge were often quite variable over geologic time, causing variability in the streams erosive and depositional characteristics (Soukup et al 1984). This caused the resulting outwash deposits to vary in areal extent, thickness, and grain size. As shown on Figure 3-3, four of the ten sites are located in part or in whole in an area of granular outwash deposits. In some areas, earlier sand deposits were later covered over by till from subsequent glacial advances, thus forming buried aquifers. Glacial Lake Benson was located in Swift County in the area of the southern Hancock Pro Pork facilities (Wright 1972). Broad alluvial fans comprised of medium-grained sands were deposited by glacial streams entering Glacial Lake Benson from the north. Finer sands and silt were deposited farther south near the City of Benson.

In geological terms, then, granular outwash deposits were several times deposited over geologic time on top of much finer glacial till. As a result, the surficial aquifer (the granular material) is underlain by a low hydraulic conductivity layer of glacial till, and is thereby hydrogeologically isolated from deeper layers.

Soil surveys for Stevens, Pope, and Swift counties indicate soils in the area of many of the HPP facilities consist primarily of nearly level to gently sloping, silt loam to clay loam (relatively cohesive) soils. However, some of the manure land application areas utilized by HPP facilities occupy land composed of granular soils. Figures 3-4a through 3-4c illustrate soil associations present in the area of the HPP facilities.
3.3 REGIONAL HYDROGEOLOGY AND HYDROLOGY

3.3.1 Ground Water Resources

The project area was glaciated repeatedly and now contains five glacial aquifers, four of which are buried beneath (and separated from each other by) layers of relatively impermeable glacial till. The fifth aquifer unit, the surficial aquifer, is extensively used where present and is not provided with the natural geologic protection of overlying confining layers as the buried aquifers are. The four buried aquifers, named the Morris, Benson-upper, Benson-middle, and Benson-lower, are comprised primarily of sand and gravel bounded above and below by relatively impermeable glacial till. The surficial aquifer is near the surface and does not have an overlying low permeability layer.

The glacial till is composed of an unsorted mixture of clay, silt, sand, gravel, and boulders that were primarily deposited beneath stagnated or advancing glaciers. The buried aquifers constitute the main source of ground water where the surficial aquifer is thin or absent. Low vertical hydraulic conductivity of the till layers allows these layers to act as confining units above and below the buried sand and gravel aquifers. These low conductivity layers provide natural protection against the downward migration of contamination from surface sources.

The areal extent and saturated thickness of the surficial aquifer in the area of the HPP facilities is shown in Figure 3-5a. The figure illustrates that the surficial aquifer is present beneath the farrowing, Olson, Nohl, and part of the Schaefer and Solvie facilities. The Spohr, Paul, Charles, Zeltwanger, and Greiner facilities are underlain by glacial till. The saturated thickness of the surficial aquifer ranges from approximately 20 to 40 feet (Delin 1986). Depth to the water table ranges from zero, where surface water bodies exist, to approximately 40 feet below grade.

Regionally, ground water flow within the surficial aquifer is primarily north to south (Delin 1986). Locally, ground water flow is toward the surface water bodies, including the Pomme De Terre and Chippewa Rivers. Vertical flow within the surficial aquifer is predominantly downward (Soukup et al 1984). Figure 3-5b illustrates the configuration of the potentiometric surface in the area of the HPP facilities. Where buried drift aquifers coalesce with the surficial aquifer, ground water generally flows upward from the confined aquifer to the surficial aquifer (Delin 1986).

Figures 3-5c through 3-5k illustrates the areal extent and thickness, potentiometric surface, and top elevations of these surficial and buried drift aquifers. Figure 3-5l contains a generalized geologic cross-section illustrating the vertical distribution of the aquifers. Table 3-1 summarizes the aquifers’ characteristics and depositional history.
3.3.1.1 Area Ground Water Well Use

Ground water use near the HPP facilities was evaluated by means of well record information obtained from the April 1, 2002 version of the Minnesota Geological Survey (MGS) County Well Index (CWI) and the Minnesota Department of Natural Resources ground water appropriation-permit database. Well information was collected for locations within one-half mile of each potential manure land application area's boundaries. The CWI currently includes information on 183 wells within these areas. Figure 3-6 shows the location of high capacity wells in the area that are generally used for irrigation and public supply. Uses of the 183 CWI wells include:

- five (5) for public water supply;
- 74 for irrigation;
- 58 for domestic water supply;
- 16 test wells, and
- 30 of unknown use.

All five public water supply wells are completed in Quaternary buried artesian aquifers. The 74 irrigation wells include 15 completed in Quaternary buried artesian aquifers, two completed in undifferentiated Quaternary deposits, 35 completed in the surficial water table aquifer and 23 undefined by aquifer. The domestic wells and wells of unknown use include wells completed within Quaternary buried artesian aquifers and within the surficial water table aquifer. Aquifers used by the 16 test wells were not indicated, but, based on the wells' depths, most appear to be completed within Quaternary buried artesian aquifers.

3.3.2 Ground Water Quality

The project site is located in a historically agricultural area of western Minnesota. The water quality of these aquifers is described by both regional water quality information and local water quality data collected by the MPCA at certain HPP sites. This section will focus on nitrate, since it is the most common ground water contaminant assessed related to feedlot impacts. In sufficient amounts in drinking water, nitrate can cause “blue baby syndrome” (methemoglobinemia) in young children.

The MPCA has conducted a significant amount of research on the fate of nitrogen compounds in the environment, and has concluded that geochemistry is an important factor in understanding the distribution of nitrate in ground water. In a “nitrate stable” (oxygen-rich or “oxidizing”) environment, the chemistry of the ground water system does not support denitrification. Any nitrate entering such an environment will therefore remain as nitrate. Conversely, in “nitrate unstable” (oxygen-poor or reducing) environments, any nitrate entering the system will rapidly undergo denitrification. A given concentration of nitrate will, therefore, pose a greater risk to
ground water receptors in a “nitrate stable” environment than it would in a “nitrate unstable” environment. For the purpose of assessing the fate of nitrate in ground water the MPCA defines nitrate-stable conditions as including all of the following parameters: an oxidation-reduction potential (Eh) > 250 mV, dissolved oxygen (DO) concentration of > 1 part per million (ppm), and a filtered iron concentration of < 0.1 ppm.

The general water quality in the area of the HPP project is presented in a MPCA report, the Baseline Water Quality of Minnesota’s Principal Aquifers, Northwest Region. This report notes that while nitrate is an important chemical of concern in the region due to the intense agricultural activities, relatively few detections of nitrate occurred in the water samples. Of the 182 wells samples in the report, only 17 reportedly detected nitrate, and only one exceeded the Health Risk Limit (HRL) of 10 mg/l. The estimated mean concentration of nitrate was less than 0.2 mg/l, well over an order of magnitude lower than the HRL.

The report concludes that the lack of nitrate in the wells from this region is due to the geochemistry of the aquifers. The report also notes that Eh values in the region, particularly in the surficial aquifer wells, are less than the values from similar aquifers statewide. This data suggests that “nitrate unstable” condition exist in these aquifers.

Water quality data available from the CWI supports the conclusion in the MPCA report. Examination of the CWI water quality database revealed that 23 wells were sampled in Stevens, Pope and Swift Counties. Depths of these wells ranged from 35 to 356 feet bgs. Four of these wells are reported to be in the surficial aquifer with the remaining wells screened deeper within buried aquifers. None of the samples from these wells detected nitrate above 10 mg/l. The range of nitrate concentrations from the wells screened within the surficial aquifer was 0.49 to 8.8 mg/l. The range of nitrate concentrations from the remaining wells was 0.49 to 3.2 mg/l.

In addition to the regional data discussed above, the MPCA collected water quality samples at three of the HPP facilities. Samples were obtained from temporary monitoring wells installed at the farrowing site, the Olson site and the Schaefer site.

This investigation detected nitrate levels above the HRL at all sites. However, this does not by itself indicate the potential for significant impacts, nor that the sites themselves are necessarily the source of contamination.

At the farrowing site, the MPCA sampling found 25.59 mg/L of nitrate upgradient of the nursery barn, indicating a high level of groundwater nitrate originating from unknown sources before the groundwater reaches the site. Downgradient, the highest reading was 30.42 mg/L, which MPCA staff believe to be a nonsignificant increase, likely attributable to the high variability in local groundwater quality conditions. The staff’s judgment on this is strongly influenced by the fact
that sodium concentrations found both up- and downgradient were nearly identical, indicating no additions from the barns.

At the Olson site, the highest upgradient value was quite low at 0.45 mg/L, likely reflecting the upgradient land use, which is a large Conservation Reserve Program (CRP) field. The highest downgradient value was 12.25 mg/L, which MPCA staff view as a significant increase over background, likely caused by runoff from the Olson barns. Here, the sodium concentrations were higher downgradient than upgradient, reflecting a likely contribution from the barns.

The Schaefer site data were inconclusive, due in large part to the fact that the soils at that site are cohesive in nature. Several sampling wells were inserted around the barns, but none produced significant volumes of ground water, due to the slow movement of ground water through such soils. The three samples obtained there produced nitrate values of 22.94, 50.02, and 3.19 mg/L. No upgradient value was identified because it was impossible to characterize the ground water flow gradient under the sampling conditions existing at that location. It is thus impossible to say which, if any, of the values found is the upgradient condition. The variable numbers found may, again, reflect the variability in area groundwater quality, and have nothing to do with contributions from the barns. Additional study to adequately characterize ground water quality conditions at this site would require considerably more work and a multi-seasonal survey to, first, adequately characterize the background condition, and, second, to identify the contributions, if any, from the barns. Since the Schaefer barns are newly constructed according to MPCA requirements for new feedlot facilities, MPCA judges the potential that the barns are making significant such contributions as minimal.

Further, while this investigation did detect values for nitrate above the HRL at all three locations, these detections were all from the uppermost portion of the aquifer. When samples were obtained from deeper within the aquifer, the results indicated denitrifying conditions with depth and non-detectable concentrations of nitrate.

It should be noted that these site-specific data were collected from very shallow depths and thus are not necessarily representative of drinking water quality in the region (since regional drinking water supplies mostly come from deeper aquifers). Therefore they cannot be compared directly to the above regional data. However, the data are consistent with the findings of the MPCA report; reducing (nitrate unstable) conditions do occur with depth, which accounts for the nitrate reduction in the lower aquifers. This indicates that, even where nitrate concentrations in the ground water were found to be elevated—and regardless of source—the tendency seems to be that nitrate is rapidly attenuated by reducing conditions with increasing depth. The potential for significant impacts caused by the barns is correspondingly minimal, even if they are contributing to the nitrate load.
Further discussion of the fate of nutrients and pathogens in the ground water is provided in the Literature Review Section 3.7.1 of this EIS.

3.3.3 Surface Water Resources

The HPP project is located within two major watersheds of the Minnesota River, the Pomme de Terre and the Chippewa Watersheds, with most of the HPP project located within the boundaries of the Chippewa River watershed. The Paul and Spoehr manure land application fields lie within the Pomme de Terre watershed (Cotter et al 1968). All other manure land application fields utilized by Hancock Pro Pork facilities lie within the Chippewa River watershed (Cotter et al 1966). These two major watersheds, along with the Upper Minnesota River and Lac Qui Parle watersheds, make up the headwaters of the Minnesota River.

Page Lake and Lake Emily lie north of the HPP finishing feedlots and are located within the Chippewa River Watershed. Judicial Ditch 9 (JD 9) is a man-made waterway that outlets through additional ditches into the Chippewa River. JD 9, or private ditches connecting to JD 9, runs through several of the finishing feedlot sites as well as the farrowing facility's land application areas. See Figures 3-7 for boundaries of the watersheds and the locations of the lakes, rivers, and JD 9.

3.3.3.1 Watershed/Ecoregions

Minnesota ecoregions were defined by means of an Environmental Protection Agency (EPA) approach developed in Oregon (Heiskary and Wilson 1989). These ecoregions were delineated by means of land use, soils, surface form, and potential natural vegetation data. There are two ecoregions in the vicinity of the HPP project area, the Northern Glaciated Plains (NGP) and the North Central Hardwood Forest (NCH). The HPP project lies entirely within the NGP, with the NCH situated along the eastern edge of the project area. The main differences between the regions are the amount of land cultivated (NGP 80% and NCH 5%) and number and depth of surface waters. The NGP has fewer lakes and they are larger and shallower than those found in the NCH (Heiskary and Wilson 1989). The types of lakes within the NCH are diverse, and range from larger, shallow lakes to smaller, deeper lakes that may thermally stratify.

The surface water quality in the NGP in 1989 was characterized by high phosphorus (130-250 ug/ml), Secchi transparency between 0.3-1.0 m and Total Nitrogen (TN)/Total Phosphorus (TP) ratios ranging from 5:1 to 15:1, indicating that nitrogen is the limiting factor. TN:TP ratios greater than 17:1 are generally considered phosphorus limited, while ratios less than 10:1 indicate nitrogen limitation (Heiskary 1997, Heiskary and Wilson 1989). High incidence of algal blooms and excessive aquatic plant growth indicate hypereutrophic lakes. Total phosphorus levels are higher during the summer.
The surface water quality in the NCH ecoregion is as diverse as the types of lakes found in the ecoregion. A wide range of trophic states can be expected because the NCH ecoregion has a much more diverse population of lakes with differing characteristics. Some lakes may have small surface area, and have greater depth (20 m), while others may have large surface area and shallower depths. The deeper lakes typically thermally stratify, allowing seasonal circulation to take place. This helps to decrease the TSS and nutrient concentrations. Fifty percent of the lakes have a Secchi disk reading of 1.4 m (approximately 4.5 feet) (Heiskary and Wilson 1989). Typical summer values for total phosphorus are between 23-50 mg/L and TSS concentrations are less than 4 mg/L.

Pomme de Terre Watershed
The Pomme de Terre Watershed covers 905 square miles, flowing from Stalker and Long Lakes in Ottertail County with no major tributaries. At a flow rate of 110 cubic feet per second, the Pomme de Terre Watershed represents approximately 60 percent of the Minnesota River Basin flow where it enters the Minnesota River system at Marsh Lake in Appleton, MN (Minnesota River Assessment Project 2000). However, the Pomme de Terre represents only 9 percent of the total acreage of the entire Minnesota River watershed, and less than one-hundredth of the total discharge of the Minnesota River when it enters the Mississippi River in St. Paul, MN (Waters 1977). The Pomme de Terre and the Upper Minnesota River watersheds have the smallest influence on the Minnesota River Basin overall (Waters 1977, MPCA 2001a). The Pomme de Terre River watershed boundary in the vicinity of the HPP project is shown on Figure 3-7.

The Pomme de Terre River rises in the NCH ecoregion and meanders through a series of lakes and marshes, surrounded by wooded hills and meadows, until it reaches Morris, MN. The marshes and lakes act as deposition sites for sediment before reaching the river. Downstream of Morris, MN, the character of the river changes, becoming more turbid until it reaches Marsh Lake (MPCA 2001a). The soils within the lower Pomme de Terre watershed are increasingly erodible. The Pomme de Terre River enters the Minnesota River south of Appleton, MN, creating Marsh Lake. Marsh Lake is a natural reservoir formed by the Pomme de Terre delta, which creates a natural dam as it enters the Minnesota River.

Chippewa River Watershed
The Chippewa River Watershed is one of the largest major watersheds of the Minnesota River. Its drainage area consists of 2085 square miles. The Chippewa River headwaters are located in central Minnesota, in Douglas County (Waters 1977, MPCA 2001b). The Chippewa is 130 miles long with three smaller tributaries; the Little Chippewa River, Chippewa East Branch, and Shakopee Creek. JD 9 also drains a portion of the watershed and enters the Chippewa River just below Benson, MN. The Chippewa River joins the Minnesota River at Montevideo, MN. It represents approximately 40 percent of the Minnesota River Basin at the point of entry (Waters
With a flow rate of 315 cubic feet per second, the Chippewa River is almost three times larger than the Pomme de Terre.

This watershed covers both ecoregions, the NGP and the NCH. The eastern half of the watershed lies within the NCH ecoregion and is composed of primarily granular soils, with a resulting increased potential for sediment delivery to streams. The western half of the watershed lies within the NGP ecoregion. The soil types in this area range from clay to loam and sand. The western half of the watershed is extensively tiled and the erosion potential is high near the stream banks (MPCA 2001b).

JD 9 was constructed between 1917 and 1920, and consists of 10.4 miles of open ditch and a drainage area of 53 square miles. JD 9 flows drains several HPP project properties. JD 9 is part of a drainage ditch system that is tributary to the mainstem of the original collection ditch, County Ditch 3 (CD 3) (MDNR 1993). Several additional smaller manmade waterways (County Ditches 7 and 23, and Judicial Ditch 8, Branch E1) also connect to CD 3. CD 3 is directed into the Danvers Wildlife Wetlands and Management Area and eventually discharges into the Chippewa River. The drainage system worked well until after the drought years in the 1930s when additional private ditches were constructed and connected to the ditch system. The waters from JD 9 historically flowed into CD 3 and into the Danvers Wildlife Management Area. However, in 1986 a new manmade waterway, County Ditch 83 (CD 83) was constructed to bypass the Danvers Wetland, thus diverting the water from JD 9 and the other smaller ditches from CD 3. During periods of high flow, a portion of JD 9 runoff still enters Danvers Wildlife Management Area (MDNR 1993). CD 83 outlets into the Chippewa River south of Benson, Minnesota. See Figure 3-7.

3.3.3.1.1 Lake Water Quality

Lake Emily Water Quality

Lake Emily is the larger of the two lakes within the HPP project area. Lake Emily is located in the NGP ecoregion, with an approximate surface area of 2246 acres (MDNR 2000). Lake Emily is a large, shallow, hypereutrophic lake (MDNR 2000), with a maximum depth of 7 feet. There are very few areas with aquatic vegetation. The MDNR stocks the lake with walleyes for recreational use, but the lake does sustain other fish populations as well (MPCA ND).

Water quality throughout Lake Emily is consistently poor. Secchi disk data, indicating the clarity of the water, average approximately 1.5 feet. The sediments are continuously resuspended by the wind. Phosphorus concentrations in a lake typically less than 40 ppb indicate that the lake supports recreational swimming (MDA 2000). However, Lake Emily's mean total phosphorus (TP) average is 122 ppb (MDNR 2000). Chlorophyll-a is also used as an estimate of the amount of algae in water. Chlorophyll-a between 30 and 60 ppb typically indicates that
nuisance algal blooms are likely to occur (Heiskary and Wilson 1989). Lake Emily's chlorophyll-a average is 57.6 ppb (MDNR 2000).

Page Lake Water Quality
Page Lake is much smaller, but deeper than Lake Emily, with a surface area of 372 acres and a maximum depth of 17 feet (MDNR 1995). Page Lake is located within the NGP ecoregion. Although deeper than Lake Emily, Page Lake is still a relatively shallow lake that is hypereutrophic and prone to algal blooms during the summer. Emergent vegetation is rare. The MDNR stocks the lake with walleyes and northern pike for recreational use and the lake also sustains other fish populations (MPCA ND).

Water quality throughout Page Lake is consistently poor. Secchi disk data indicate the clarity of the water averages approximately 2 feet. Page Lake's mean TP average is 329 ppb and its chlorophyll-a average is 30.5 ppb (MDNR 1995).

Stevens County monitored Page Lake between 1993 and 1996. There was an increase in total suspended solids (TSS) concentrations from 1993 to 1996, as shown in Figure 3-8a. The TP concentrations, illustrated in Figure 3-8b, showed a decreasing trend from 1993-1995 but a rise in 1996. The dissolved oxygen concentrations, shown in Figure 3-8c, were relatively constant except during August of 1995 and 1996. Page Lake zooplankton counts shown in Figure 3-8d indicate that algal blooms increased from 1994 to 1996.

3.3.3.1.2 Stream Water Quality

Pomme de Terre River Water Quality
The regional water quality in the Pomme de Terre watershed is poor, especially in the lower reaches before it enters the Minnesota River. High TSS concentrations are due to the high erodibility of the soil and sediment loading from reduction of wetlands within the watershed (MPCA 2001a).

Stevens County Environmental Services monitored the water quality of the lower Pomme de Terre River from 1994-1996. The most northerly monitoring location is at County State Aid Highway (CSAH) 76, with 4 additional stations placed intermittently downstream, the last placed near CSAH 8. The stations at CSAH 8 and CSAH 10 are directly upstream of the HPP Project, as shown on Figure 3-7. The other three stations are located several miles upstream and their data are presented in Figures 3-8e through 3-8h. Water quality data for the Pomme de Terre River are also being collected and analyzed by the Pomme de Terre Watershed Project, but this data is not yet available.

The Stevens County Data shows that the dissolved oxygen, Secchi disk, nitrate, and TP concentrations in the Pomme de Terre are at the highest concentrations during the summer. At
CSAH 8, the concentrations for TP are between 0.25-0.3 mg/L. All are below the recommended concentrations of 1 mg/L for the NPG Ecoregion (Heiskary and Wilson 1989). The concentrations upstream of CSAH 8 are below 0.15 mg/L. The highest TSS concentrations occur downstream of Morris, MN, which correlates with the presence of erodible soils in the area. The high TP concentrations in the summer are probably due to surface water runoff during storm events. The nitrate concentration did not exceed 1.4 mg/L at any of the sampling sites.

**Chippewa River Water Quality**

The MPCA and Chippewa River Watershed Project (CRWP) studies of the Chippewa River Watershed have shown that pollutant levels are high. Pollutants of concern are the same as throughout the Minnesota River Basin: high nutrient content, suspended solids, and pathogens (MDA 2000). The high concentrations of suspended solids and nutrients can be linked to artificial drainage patterns and reduction of wetlands in the watershed (Minnesota River Assessment Project 2000).

The overall health of the Chippewa River watershed has been characterized and studied since 1999 by the CRWP. The data are organized according to the sub-basins within the Chippewa River watershed. The HPP project is located within 3 of the sub-basins of the Chippewa River watershed: the Lower Mainstem, the Middle, and the Little Chippewa sub-basins. Data from these sub-basins are shown on Figures 3-8i through 3-8l. The Middle and Little Chippewa sub-basins contain the Little Chippewa tributary, Lake Emily, and its outlets. The Lower Mainstem sub-basin is drained by JD 9. Water flows in JD 9 southeast from the HPP project area into CD 3, then around the Danvers Wildlife and Wetlands Management Area (WWMA), and eventually enters the Chippewa River. Under normal flow conditions, runoff from the HPP project does not flow into the Danvers WWMA. The boundaries of the watershed and locations of streams are shown in Figure 3-7a.

Two feedlots within the HPP project are located in the Middle and Little Chippewa sub-basins. Farther downstream, six additional HPP facilities are located within the Lower Mainstem sub-basin. The water quality data for the Middle and Little Chippewa sub-basins indicates that average TSS loading rates are decreasing, whereas total phosphorus, ortho-phosphorus (a form of phosphorus more biologically available than total phosphorus) and nitrate loading rates are increasing. The average annual concentrations for TSS, total phosphorus, ortho-phosphorus, and nitrogen show large, annual fluctuations in concentrations, indicating that they are sensitive to flow and precipitation, as well as possibly other factors.

Fecal coliform data was collected within the Chippewa Watershed from 1998 through 2001. The data indicates fecal coliform concentrations are static with the exception of a spike occurring in late 1998 (Figure 3-8i). Fecal coliform concentrations above 200 CFU/100 ml are considered to indicate fecal impairment.
JD 9, Cottonwood Creek, and portions of Shakopee Creek drain the Lower Mainstem sub-basin. The water quality in the downstream sub-basin is poorer than the upstream sub-basin, with TSS concentrations three times higher than in the Middle and Little Chippewa Sub-basin, as shown in Figure 3-8k. Figure 3-8l indicates that sampling phosphorus and nitrogen levels are relatively constant at the sites up and down stream of the HPP project area.

3.4 REGIONAL WILDLIFE AND HABITAT

3.4.1 Terrestrial Ecology

Historically, western Minnesota has been classified as part of both the Tallgrass Prairie and the Prairie Pothole Regions (TPR and PPR, respectively). The TPR extends from the northwest to southeast in Minnesota. Dominant grasses such as big bluestem, switchgrass and Canada wildrye typify the TPR. Marsh grasses such as reed canarygrass characterize the PPR. However, land use in western Minnesota has been agricultural since populations began to settle there, and the original ecosystems have been greatly altered as a result.

The U.S. Fish and Wildlife Service-Morris Wetland Management District conducts studies and compiles a bird checklist that contains counts of bird populations within public lands in a 7-county region that includes Big Stone, Chippewa, Lac Qui Parle, Yellow Medicine, Pope, Stevens, and Swift Counties. The bird checklist describes various bird species and classifies them into groups according to how abundant they are. The more common birds are ducks (several different species), geese, hawks, ring-necked pheasants, as well as common small birds such as sparrows, doves, swallows, and thrushes (USFWS 1991). Deer, coyotes, foxes, and raccoons also occur in the area.

3.4.2 Aquatic Ecology

The Pomme de Terre River meanders toward the Minnesota River, connecting a series of lakes and cattail and canarygrass marshes, particularly in its headwaters. Many of the state Waterfowl Production Areas in Stevens County are along the Pomme de Terre River. The lower portion of the Pomme de Terre does not flow through marshes and lakes. The HPP project area is located in the lower portion of the watershed, which is typically characterized by relatively erodible soils and higher sedimentation rates in the river itself.

Aquatic species such as walleyes, northern pike, forage fish, and plants such as sago pondweed and clasping leaf are present within Page Lake. Aquatic plants are uncommon in Lake Emily.

3.4.3 Rare and Endangered/Threatened Species

The DNR Natural Heritage and Nongame Research Program (NHNRP) identified nine known occurrences of rare species, including bald eagles, or natural communities, including dry and
mesic prairie, in the vicinity of the area searched that included the HPP feedlots and land application areas. The database used is completely updated for Stevens and Swift Counties. Survey work is in progress for Pope County. The information available for the rare species within these counties is believed to be reasonably complete. However, there may be other rare or otherwise significant species and natural communities in the project area that are not known at this time. **Table 3-2** presents the rare and endangered species as reported by DNR. See also **Appendix D**.

Other species of concern are two types of mussels, the Creek Heelsplitter and Black Sandshell Mussels.

### 3.5 Animal Health

#### 3.5.1 Swine Health Maintenance

Hancock Pro Pork feed generally consists of 70-90% corn and soybean meal. The remaining fraction of feed consists of specialized premixes that contain different percentages of nutrients for specific hog types. The premixes contain varying percentages of vitamins A, D₃, and E, essential amino acids, salt, minerals (zinc, copper and selenium), and low dosage antibiotics. See **Table 2-2** for specifics on additive and antibiotic use at the farrowing and finishing sites. Nutritional needs of swine vary throughout stages of development. The vitamins, minerals, and pharmaceutical feed additives are intended to promote growth, feed intake, and improve feed efficiency, while controlling disease outbreaks.

Animal health maintenance has always been an important issue at feedlots. As feedlots have gotten larger, this has become even more of an issue as disease in a larger feedlot can affect more animals and have greater adverse effects on the facility’s profitability. The closed confined areas increase contact between healthy and infected pigs, increasing the probability of disease outbreak. Large feedlots, such as the farrowing facility, have greater risk for disease outbreaks simply due to the large number of hogs within confined areas that are in close proximity to one another. Modern feedlot operators go to great lengths to minimize the potential for disease transfer, as well as to control disease if it occurs.

Common diseases that occur in swine, but not necessarily at any one feedlot in the HPP project, are ileitis (an intestinal disease), bacterial enteritis, bacterial pneumonia, swine dysentery, and other respiratory and skin diseases. While no feedlot in the HPP project has reported high incidence of disease, all use feed additives and pharmaceuticals at subtherapeutic levels to prevent and control outbreaks of the diseases mentioned above, as do many feedlots nationwide.

Subtherapeutic use of antibiotics is a common practice in animal agriculture industry and has economic benefits for the feedlot operator. An obvious reason for this practice is to minimize the potential for disease outbreaks. Just as important to the operator, however, is that
subtherapeutic use of antibiotics often improves animal growth rates and feed efficiency, thus shortening the time needed to finish an animal for market. Indeed, the federal Food and Drug Administration has approved the use of certain antibiotics for both disease prevention and growth enhancement (Wallina 2002).

### 3.6 Socioeconomics

This section of the EIS provides a cursory assessment of community demographics, land use, social and economic issues, and the anticipated impacts of the proposed project. The impacts of the project have been assessed by means of data collected from various government agencies, including the U. S. Census Bureau, counties in the vicinity of the proposed action, and the Minnesota Planning Agency. The relevant data encompasses Pope and Stevens Counties, and the west central region of Minnesota.


The GEIS economic discussion focuses on changes in scale in agriculture and strategies aimed at maintaining competitiveness in the global market. Economic and structural changes in animal agriculture have been linked to concerns about the vitality of rural communities. The treatment of economics in the GEIS focused mainly on four overriding forces: (1) evolution of the food-producing system into more tightly coordinated supply chains; (2) information technologies; (3) globalization; and, (4) public skepticism about science, technology, and globalization.

#### Community Demographics

The State Demographic Center (SDC) in the Minnesota Planning Agency provided census data and other relevant information about Stevens and Pope Counties. Data on population, households, and land areas for Stevens County is illustrated in Table 3-3. The population in Stevens County has undergone a moderate reduction during the past thirty years. The number of households has also declined during that timeframe. The increase in land area in Stevens County from 1980 to 1990 could be the result of more precise survey equipment and the use of Global Positioning Systems (GPS).
The population in Pope County (Table 3-4) has grown moderately during the past thirty years. The number of households has also increased during that timeframe. The slight increase in land area could also be attributed to more precise survey equipment and the use of GPS.

The State of Minnesota Census 2000 shows that the Stevens County population decreased by approximately 5.48 percent and the Pope County population grew by approximately 4.57 percent. While Stevens County has had a moderate decrease in households, Pope County has experienced a strong growth in households.

The communities near the HPP project sites in Pope and Stevens Counties include Walden, Hoff, Horton, Hodges, and Moore Townships, and the City of Hancock. The populations for these rural communities are presented in Table 3-5.

Population figures for the six townships indicate that population in those communities sustained moderate changes during the past ten years (1990 to 1999).

The number of households within a one-mile radius of the proposed project sites is shown in Table 3-6. According to the 2000 Census, the average number of persons in a household in Pope County was 2.42 and in Stevens County, 2.43. Therefore, it is estimated that a total of 148 people live within a mile of the various HPP sites.

3.6.1 Land Use

The GEIS (Minnesota EQB 2001) presents five recurring themes for land use: changes in animal agriculture, quality of life impacts, community interactions, future of animal agriculture, and changes in population dynamics, all of which would affect decisions on land use in Pope and Stevens Counties. The most significant land use decisions regarding feedlots are expected to be those related to density in residential and commercial development and to cumulative environmental impacts.

Pope County completed its comprehensive land use plan during the summer of 1998. This plan defines three types of farms: specialized, hobby, and traditional.

Specialized farms are farms owned by two or more families who share ownership, management, and labor. They will specialize in one enterprise, such as dairy, hogs, or turkeys. They will utilize the latest in technology and research to be profitable and competitive with other producers in the United States and overseas. Generally, the HPP project falls into this category.

The hobby farm and traditional farm have less ambitious goals. The hobby farm may generate revenues of less than $1,000 per year. The traditional family farm is owned by a single family
where one spouse would seek employment in the community and the other spouse may also have a part-time job in the community to make ends meet on the farm.

Stevens County does not have an approved comprehensive land use plan. Zoning for the County is accomplished by means of existing ordinances.

3.6.2 Economics

Several economic issues were discussed in the GEIS (Lazarus et al. 1999; Lazarus et al. 2991) that may characterize an area with existing or proposed feedlot operations. The following summarizes the economic issues in an area with existing or proposed expansion of feedlot operations.

Table 3-7 shows the number of all farms and number of hog and hog farms in the State of Minnesota and in Pope and Stevens Counties. The USDA assesses all farms in the state every five years. Therefore, their data is presented in five-year increments starting in 1978 and ending in 1997. The USDA has not yet collected and analyzed data for the state farms for the years 1998 to 2002.

According to the USDA, between 1978 and 1997 the number of farms raising hogs within the State of Minnesota decreased from 25,703 to 7,512. This represents a decrease of 18,191 Minnesota hog farms in twenty-five years. The total number of hogs on farms in the state increased only modestly from 1978 to 1992 (4.1 million in 1978; 4.7 million in 1992). By 1997, there were 5.7 million hogs on Minnesota farms, one million more than five years before in 1992, and on 5,613 fewer farms.

Similar trends in the number of hogs and hog farms have been recorded for Pope and Stevens Counties. Between 1978 and 1997 the number of farms raising hogs in Pope County decreased from 276 to 44. The decline was moderate from 1978 to 1992, but accelerated from 1992 to 1997. While the total number of hogs in Pope County decreased somewhat from 1978 to 1997 (36,545 in 1978; 27,438 in 1997), the hogs were found on 232 fewer farms than in 1978 in Pope County.

Between 1978 and 1997 the number of farms raising hogs in Stevens County decreased as well, from 249 to 83. While the total number of hogs in Stevens County increased by about 42% from 1978 to 1997 (60,410 in 1978; 85,979 in 1997), the number of farms with hogs has declined by 166 farms.

The total number of hogs in Pope and Stevens Counties increased slightly from 1978 (96,955) to 1997 (113,417). The hogs were raised on 398 fewer farms than in 1978. This represents an average size farm of approximately 890 hogs in the two county area, compared to the 5.7 million
hogs and 7,512 hog farms in the state, representing an average size farm of approximately 780 hogs.

The GEIS found that the swine industry in Minnesota underwent significant consolidation from 1982 to 1997, with decreasing numbers of Minnesota farms and increasing numbers of hogs and hogs per farm. Between 1982 and 1997, the number of farms with hogs declined by 64% (from 20,813 to 7,512). In relation to all farms, the percentage of hog farms decreased by 54% between 1982 and 1997 (from 22% of all farms to 10%). The number and percentage of farms with hogs decreased in every county of the State, with the highest decreases in the northern two-thirds of the state. From 1982 to 1997, the number of hogs in the state increased by 28% (from 4,473,181 to 5,722,460). Over the same period, hogs per farm increased by 254% (from 215 to 780). However, the geographic distribution of hog operation also changed during this time. The number of hogs per thousand acres fell in the northern half of the State between 1982 and 1997, as well as in several of the far southeast counties. Increases were concentrated in the southwest and south central counties. Pipestone County had the highest increase in hog numbers per thousand acres, at 162%, followed by Martin at 150%, and Blue Earth at 124%.

3.7 Research and Literature Review – Human Health

3.7.1 Ground Water Impacts

The analysis of ground water impacts from this project focuses on nutrient, chemical, and pathogen migration from manure storage and manure land application. This section reviews the migration potential of these compounds.

If manure is applied in excess of agronomic rates, the nutrients can build up in the soil, leach from the soil, and negatively impact ground water. Numerous factors such as soil type, nutrient content of manure, time and rate of application, and crop rotation affect the concentration of nutrients within the soil.

The speciation of nitrogen in the environment is largely microbially mediated via oxidation/reduction (redox) reactions. In aqueous systems, the predominant species (NO₃⁻ and NO₂⁻ or NH₄⁺, NH₃ and organic forms) are dictated by the redox conditions at the sampling location.

Ambient sources of nitrogen from most aquifer materials are insignificant. Consequently, any nitrogen present is typically human induced from the ground surface. Nitrogen must leach through the soil and unsaturated zones to reach ground water, generally in one of two scenarios, point-source introduction of nitrogen on a large scale, or nonpoint-source leaching of nitrogen through the unsaturated zone to ground water. Point source migration could occur from leaks in the containment pits, from individual domestic septic systems, or from massive spills, while potential non-point sources include the land application of manure and other fertilizers.
Nitrate is highly soluble in water and therefore quite mobile. Nitrate readily leaches through the soil and unsaturated zone to ground water. The two major mechanisms for the mitigation of nitrate-impacted water are dilution through dispersion and chemical reduction (denitrification).

Nitrogen is an essential plant nutrient, but if applied in excess of the crop’s needs it is subject to leaching and may negatively impact water quality. Nitrogen exists in the soil system in many forms and changes very easily from one form to another. These include inorganic forms such as ammonium ion (NH$_4^+$), ammonia gas, and nitrate (NO$_3^-$) and organic forms (such as amino acids and urea) in organic matter and crop residues. NH$_4^+$ and NO$_3^-$ are readily available for plant uptake, while organic nitrogen is not. The rate and timing at which these forms of nitrogen change is heavily influenced by physical and chemical properties of a given soil and prevailing climatic conditions.

Sixty to eighty percent of the nitrogen in swine manure is in the form of NH$_4^+$ (Ruhl 1999; Ham et al 1999). The remaining 20 to 40% of the nitrogen is in the other forms. Therefore, the majority of the nitrogen in swine manure is readily available for plant uptake. If the plant does not utilize the nitrogen in the soil, several processes will facilitate the loss of the nitrogen from the soil system.

Plants utilize nitrogen in the forms of NH$^+$ (ammonium ion) and NO$_3^-$ (nitrate ion). NH$_4^+$ has a positive charge and therefore is attracted and held by soil particles and soil organic matter, which are negatively charged. Consequently, NH$_4^+$ is relatively immobile in the soil and usually does not leach to ground water. However, if the NH$_4^+$ in the soil is not taken up and utilized by the plants, it is subjected to the process of nitrification. Nitrification is a biological process that converts NH$_4^+$ to NO$_3^-$. NO$_3^-$ has a negative charge (so soil does not bind it) and is highly water-soluble. Therefore, if the plants do not utilize the NO$_3^-$, it is susceptible to leaching. The rate of leaching is most significant in granular soils due to their lower water holding capacities and resulting greater permeability.

Research suggests that nitrate has the greatest opportunity to leach when manure is applied in the fall after the growing season. During this time period, plants are not utilizing the nitrogen in the soil and the NH$_4^+$ in the manure is rapidly oxidized to NO$_3^-$. This NO$_3^-$ is then subject to leaching throughout the fall, winter, and most prominently during the spring recharge period (Munyankusi et al 1998; Randall et al 2002.). Delaying manure application, especially on granular soils, until spring eliminates adding nitrogen in the soil during the non-growing season, which will minimize the amount of NO$_3^-$ available for leaching during the spring thaw and recharge. Spring application is the most frequently cited best management practice (BMP) for reducing nitrate migration to ground water in cropland.

Ammonia and organic forms of nitrogen (the typical forms present in animal wastes) are typically attenuated in the unsaturated zone and are not likely to reach ground water in
appreciable quantities. One exception to this is the case of a large point source, as might occur beneath a feedlot or a leaking manure storage basin. All but two of the HPP facilities are comprised of barns with concrete-lined storage systems. The concrete-lined system is considered the least permeable, having an average permeability on the order of \(10^{-8}\) cm/s or less. Recent studies by the MPCA conclude that impacts of nitrogen do not pose a significant concern for ground water at lateral distances beyond 100 feet from this type of structure. Further analysis of the data by the MPCA reveals that the concrete-lined system is at least two to three times as effective as earthen-lined technologies. This research conducted by the MPCA analyzed facilities located on granular soils, and is therefore applicable to the HPP project sites.

Pathogens of concern are those that are shed into the environment in high numbers, are highly infectious at low doses, can survive and remain infectious in the environment for long periods, and/or that are highly resistant to wastewater treatment processes. *Cryptosporidium parvum*, *Giardia lamblia*, *Escherichia coli* O157:H7 (E. coli O157:H7), *Campylobacter jejuni*, *Salmonella*, *bacillus anthracis* (Anthrax), and other bacteria and viruses are listed in Table 3-8 as the main pathogens of concern, as well as their incidence of disease, and typical transport pathways.

Pathogen movement from feedlots into ground water could potentially occur during manure transfer (spills or leaks from equipment), through cracks in storage structures, or they may leach out from inadequately built (e.g., unlined) earthen manure storage pits (Mulla et al 2001). Pathogen movement into ground water could also occur after land application of manure, via preferential pathways (i.e., voids in the soil) sinkholes, or improperly sealed wells that provide a direct connection from the land surface to ground water.

There have been 14 documented incidents of *Cryptosporidium* disease outbreaks in the U.S. and Canada since 1984. Four of these events were linked to nonpoint source agricultural pollution; the others were primarily caused by septic tank and human sewage contamination (Mulla et al 2001). The presence of pathogens within the ground water near the HPP project has not been documented. Potential impacts from pathogen-impaired ground water are discussed in Section 4.2.

Manure storage facilities that leak, or land applied manure, could possibly leach pathogens and nutrients into soil and ground water. The survival of any pathogen during storage depends on several factors: size of source and loading rate (how many hogs are infected, frequency of waste additions, and dilution), temperature (cool temperatures increase pathogen survivability), length of storage, treatment, and the type of pathogen (Rosen 2000). Nutrients may reach ground water through preferential pathways in granular soils. As will be discussed in Section 3.7.4, nitrogen may act to extend the viability of certain pathogens, in addition to causing methemoglobinemia ("blue baby syndrome"). This disease results from overexposure to nitrates, resulting in the
displacement of oxygen in the bloodstream. Infants are most susceptible to the disease, hence its colloquial name.

3.7.2 Surface Water

Livestock waste can degrade surface water quality by contributing nutrients, sediment, pathogens, and various chemicals through surface water runoff and manure spills. Sources of contamination that would potentially affect surface water are runoff from fields, overflow and leaks from manure storage structures, and spills during manure transfer. An average of 20 spills per year occur in Minnesota, most originating from hog farms (Mulla et al. 2001).

The risk of pollution from land application is typically greater at smaller feedlots than at larger feedlots due to the typical manure management practices at smaller feedlots. Smaller feedlots often apply manure every 2-3 days (daily haul) year round in solid form without incorporation. Sometimes manure must be stockpiled temporarily if conditions are not favorable for land application. This increases the potential for direct precipitation contact with manure, increasing the amount of phosphorus, nitrogen, and pathogens in runoff. Frozen ground application is also more likely, which also increases the amount of nutrients and pathogens in runoff.

Nutrients are often carried in runoff from manured fields to surface waters; the potential for elevated nutrients in runoff increases with the rate of manure applied, precipitation, soil condition, and slope. Nutrient losses are least when manure is applied in late spring and greatest when manure is applied in fall; they may be excessive if manure is applied to frozen soil or snow. Nutrient losses also increase when the time between land application and rainfall is brief.

**Phosphorus**

Phosphorus is necessary for plant growth but is considered a pollutant when levels exceed the needs of healthy plant populations. The current phosphorus levels in surface waters in west central Minnesota are high. The primary source is agricultural runoff, specifically within the NGP and NCH Ecoregions.

Phosphorus is the primary nutrient lost in surface runoff, although nitrogen may be lost from fields in this way as well. Most of the phosphorus applied to soil in manure is bound in the soil, and therefore reaches surface water when eroded soil is carried there by runoff. In this way, livestock waste can contribute significantly to phosphorus loads in surface waters. Anywhere from 7-65% of total phosphorus load initially applied to soils may end up there (Mulla et al. 2001). As with nitrogen, losses of phosphorus (and nitrogen) in runoff are affected by rate, method and timing of manure application, tillage, rainfall intensity and timing, and slope steepness (Sharpley et al. 1998). Other important factors for phosphorus losses include erosion rate, soil phosphorus levels, soil phosphorus sorption saturation levels, and proximity to waterbodies (Wall and Johnson 1996).
Nitrogen
Nitrate losses to subsurface tile drainage increase with the rate of manure or fertilizer applied. Liquid manure applications cause more risk for nitrate leaching to tile drains than surface applications of solid manure, especially when liquid manure is injected. Nitrogen is the primary nutrient that can leach and impact ground water, but it represents a lesser risk of nutrient loss to surface water than phosphorous (Mulla et al 1999). Livestock waste can contribute nitrogen loads in surface water of 15%-37% of the total nitrogen load initially applied (Mulla et al 2001).

Pathogens
Surface water impairment from pathogens may be caused by domestic wastewater system failure or improper manure management at feedlots. Manure spills and land application on frozen ground, steep slopes, stream banks and lake shores, just before heavy rains, or too close to tile inlets all can result in pathogen impairment of surface water. This is a problem in many rural areas of Minnesota, causing many rivers and lakes to be generally unsuitable for swimming (Addis et al 1999). See Table 3-8.

Manure spills and improper land application may also cause fish kills. An average of 20 spills per year occur in Minnesota (Mulla et al 1999). The 1997 Report on Animal Waste by the U.S. Senate reports that 40 animal waste spills killed 670,000 fish in 1996. An MPCA press release in January 1998 reported a 100,000-gallon manure spill in Renville County, Minnesota that resulted in a fish kill of almost 700,000 (Mulla et al 2001).

Table 3-8 summarizes the principal pathogens of concern and their incidence in the environment. Most of the fecal bacteria in surface waters (over 80% throughout Minnesota) may come from manured fields (Mulla et al 2001).

Fecal coliforms are a subgroup of total coliform bacteria. Fecal coliforms are bacteria that live only in the intestines of warm-blooded animals. Fecal coliforms are used as indicators of the presence of other pathogens in surface water and ground water. Indicator bacteria may not be pathogenic in and of themselves, but high numbers may indicate fecal contamination (Rosen 2000).

Large numbers of viruses and bacteria are excreted in infected animal feces and can enter water bodies through manure land application or through direct contact. Bacteria and viruses are small enough to move through the soil (Rosen 2000). However, transport of the pathogens within the soil profile is limited due to the adsorption of the pathogens from percolating waters onto the soil material itself (Wall and Johnson 1996). Also, many pathogens are attenuated by environmental factors such as sunlight, oxygen, or temperature. The die-off rate is an important process affecting availability of the pathogens. The die-off rate for various pathogens varies depending on the type of pathogen and the seasonal environment. See Table 3-8.
In addition to poor manure management, compost piles inadequately operated or placed may also impact surface waters, particularly when insufficient cover material is used, but also when compost piles are placed in flow paths. Poorly managed compost material may leach pathogens or nutrients from the pile and possibly contaminate ground water or surface waters. The BAH regulatory program contains guidance to minimize this potential.

3.7.3 Odorous and Nonodorous Gases

The best-known odorous gases emitted from feedlots are hydrogen sulfide and ammonia. Methane and nitrous oxide (greenhouse gases), also emitted from feedlot operations, are pollutants, but not odorous. A large number of volatile odorous organic compounds (VOOCs) are also emitted. The gases are produced from urine and feces as well as microbial degradation of manure, in liquid or solid storage areas and in unincorporated land applied fields.

Hydrogen Sulfide

According to the GEIS Technical Work Paper on Air Quality (Earth Tech 2001a), hydrogen sulfide is produced from storage, handling, and decomposition of animal wastes, as well as natural sources such as swamps, sea spray, and sulfur springs. Other contributors are wastewater treatment facilities, fossil fuel combustion, and industrial processes.

The air concentrations of hydrogen sulfide will vary depending on the source and the proximity to the source from which the measurement is taken. Hydrogen sulfide levels from natural sources vary between 0.11 and 0.33 ppb, levels in urban areas typically range between 0.07 and 4 ppb, and levels measured in industrial areas range from 140 to 210 ppb. Hydrogen sulfide measurements taken near feedlots around the State of Minnesota range from 0 to 497 ppb, with an average reading of 11.5 ppb, and a median value of 5.6 ppb. High levels of hydrogen sulfide may be emitted during agitation or emptying of manure storage basins and pits. Levels during agitation have been reported as high as 1,000 ppm (Earth Tech 2001).

Concerns with hydrogen sulfide include its ability to produce strong odors (similar to rotten eggs) at low concentrations, its role in producing acid rain, and most importantly its ability to adversely affect humans at relatively low concentrations (Kellogg et al 1972; Sullivan 2003). Hydrogen sulfide is a respiratory toxicant, and can cause death at sufficiently high concentrations. When hydrogen sulfide is exposed to oxygen, such as on release to the atmosphere, it is converted via a series of chemical reactions to sulfuric acid. It can also contribute significantly to odorous emissions from feedlots.

Ammonia

Amino acids in animal feed, if not taken up and incorporated into tissue, are broken down into urea and uric acid and are excreted in animal wastes. Ammonia is produced from the decomposition of these compounds, and is also contained in some feedlot cleaning product
compounds. Animal agriculture is considered a major contributor of global atmospheric ammonia emissions (Earth Tech 2001a). Other major contributors are wastewater treatment facilities, fossil fuel combustion, and industrial processes. Ammonia is a severe respiratory irritant, and can cause death at sufficiently high concentrations.

Atmospheric concentrations of ammonia can be quite high near intense feedlot activity (Mellon et al. 2001). There, ammonia concentrations may range from 1.3 to 1,734 mg/m³, while in relatively unpolluted rural areas ammonia concentrations range from 0.2 to 17 mg/m³ (Earth Tech 2001). Ammonia is very reactive in the atmosphere and may form ammonium particulates (which can be ammonium salts or ammonium free radicals) that may be removed from the atmosphere via dry or wet deposition (Robarge et al. 2000; Dragosits et al. 2002). Dry deposition occurs more or less continuously, without precipitation. Wet deposition occurs during precipitation events. Dry deposition predominates in regions characterized by high levels of ammonia emissions from relatively low-level emission sources and is indicative of short-range transport of typically less than 5 kilometers. On the other hand, wet deposition is more significant in regions where emission levels are lower, and is indicative of long-range transport ranging from ten to thousands of kilometers from the emission source (ECETOC 1994, Fangmeir 1994, both cited in Earth Tech 2001)). Several studies in the GEIS Air TWP indicate that surface water quality can be impacted by atmospheric deposition of ammonium compounds (Earth Tech 2001). This is discussed in Section 4.3.

Volatile Odorous Organic Compounds

At least 168 different chemicals have been found in manure, and many of these volatilize to form odorous gases (O’Neil and Phillips 1992; Veenhuizen 1996, in USEPA 1996). It is these that are largely responsible for the annoying odor that emanates from feedlots. The concentration of volatile organics in the air is a good indicator of odor intensity (Guo et al. 2000), and Zahn (2000, 2001) took advantage of this fact to correlate the human olfactory response to feedlot odors with specific airborne concentrations of odorous feedlot gases. Zahn also developed accompanying field and laboratory methods for assessing odor intensity in the vicinity of feedlots, as well as graphic methods that use the resulting data to show how much of an odor problem a particular feedlot may be. These methods have been employed in the air analysis for this EIS.

3.7.4 Other Public Health Concerns

A significant portion of the following discussion is based on literature summaries and technical work papers attached to the GEIS.

Resistant Pathogens

Antibiotics were first developed in the middle of the last century, and proved to be a major leap forward in the prevention of bacterial disease in humans. However, by 1950 it had been
discovered that the addition of small amounts of antibiotics (“subtherapeutic” or “nontherapeutic” use) to animal feed enhanced growth rates and increased feed utilization efficiency in meat animals (JSC 1960 in Halverson 2001), although even today it is not completely clear how this works (Wallinga 2002). At about this time, use of antibiotics for disease prophylaxis and growth enhancement became a common practice in the US (Halverson 2001; Crooker 1999). In the half century since then, such use of antibiotics has become routine in animal agriculture, sometimes specifically to treat clinical disease, but more often on a routine basis to prevent disease (even though no clinical disease is evident) and improve growth rates. This routine use has been unquestioned until recently (Crooker et al 1999).

During the same time period, it has become increasingly clear that some pathogens have become, some increasingly, resistant to some antibiotics. Use of antibiotics is the key driver of this phenomenon, and, as overuse and unnecessary use of antibiotics in humans have been well documented, it was not initially recognized that subtherapeutic use in animals was a contributing factor (Wallinga 2002; WHO 2001). However, a “strong scientific consensus” now exists that this is so (Falkow and Kennedy 2001, cited in Wallinga 2002; WHO 1997a&b, cited in Halverson 2001), and this is supported by other evidence in the scientific literature. In Taiwan, for example, a strain of Salmonella that is resistant to fluoroquinolone therapy was found in hospitalized patients and traced back by molecular typing to herds of swine raised for food (Cheng-Hsun Chiu et al 2002; see also Halverson 2001). Fluoroquinolones are the drug of choice for severe Salmonella infections, especially in those cases where the infection is resistant to other antibiotics.

In Illinois, movement of genes resistant to tetracycline was traced from a feedlot using that antibiotic for growth promotion as far as 1/6 of a mile from the feedlot (Aminov et al, cited in Barlow 2001). The same author concluded that survival and horizontal movement of resistance genes was occurring in the environment, and for “long distances.” The federal Food and Drug Administration recently proposed withdrawing approval for use of fluoroquinolones in poultry based in part on its finding that, although these drugs had been available and routinely prescribed for treatment of Campyobacter disease in people since 1986, Campyobacter resistance to fluoroquinolones did not increase until 1996-1997, shortly after FDA approved their use at feedlots (Halverson 2001; Crooker, 1999). The FDA withdrawal process is cumbersome and time consuming, however; it required six and twenty years, respectively, for FDA to withdraw approval for diethylstilbesterol (DES) and nitrofurans in animal feed (Wallinga 2002).

Estimates vary as to the amounts of antibiotics used in humans and animals. Wallinga (2002) reports that the Institute of Medicine estimates that 20 million pounds of antibiotics are given to animals yearly (and 80% of this use is nontherapeutic), while the Union of Concerned Scientists estimate is 29.5 million pounds (93% nontherapeutic), as compared with the UCS estimate of only 3 million pounds given to humans annually. Others such as Levy (1998; cited in Halverson
estimates that 40-45% of antibiotics produced in the US are used in animals, of which only 20% are used to treat actual clinical disease, according to Halverson (2001). Wallinga further notes, however, that the livestock and animal pharmaceutical industries maintain that only 13.5% of antibiotic use in animals is for growth promotion. There is no formal mechanism for tracking use, and the line between use for growth promotion and use for disease treatment and prevention is not sharply defined, so definitive information is hard to come by. The various estimates do seem to agree, however, that the use in agriculture is extensive (Wallinga 2002).

What seems undeniable is that resistance to antibiotics is growing and this is having adverse consequences for humans (Manning 2002). The GEIS has noted the rise in recent years in the number of hospital infections that involve antibiotic resistant organisms as well as food-borne bacterial disease outbreaks (Crooker et al 1999; Addis et al 1999). The European Union has now banned the use as growth promoters of medically important antibiotics, following partial or total bans by several European countries (Crooker et al 1999; Halvorson 2001), and has proposed phasing out most other use of antibiotics as growth promoters by 2006 (Wallinga 2002). A number of concerned groups have called for similar action in this country; legislation has been introduced in Congress for this purpose (CSPI 1999, cited in Halvorson 2001; Wallinga 2002). Formal comments submitted to the Centers for Disease Control (CDC) by Environmental Defense, The American Public Health Association, Physicians for Social Responsibility, Union of Concerned Scientists, Center for Science in the Public Interest, Institute for Agriculture and Trade Policy, and others, recommended elimination of the use of medically important antibiotics as growth promoters, disclosure of data on antibiotic use, and an end to new approvals for subtherapeutic antibiotic use at feedlots.

All of the HPP facilities routinely use one or more antibiotic pharmaceuticals (Table 2-2).

Chemicals
The nation’s water supply contains traces of dozens of antibiotics, steroids, and other drugs. A percentage of these chemicals can be attributed to human activities, but a number of studies indicate that animal agricultural practices contribute a percentage as well (Kolpin et al 2002; Mellon et al 2001; Raloff 2002; Uehling 2001; Addis et al 1999; Nichols et al 1997).

Many metal-containing compounds are added to animal feed, often in the form of antimicrobials. Most of these metals are essential nutrients that can be toxic at high concentrations. In addition, some metals are known to bioaccumulate in plants. However, no documentation was found indicating adverse health effects occurring from secondary exposure to heavy metals in the environment resulting from animal production practices.

Endocrine disruptors (such as estrogen) are chemicals (both synthetic and natural) that substitute for hormones utilized in animals and humans. Typically, naturally produced hormones drift through the blood to cells that have the correct receptor molecules on the surface. Once locked
onto a receptor, a hormone may instruct a cell to divide or multiply, or increase or decrease production. Endocrine disruptors increase or decrease the effects of the natural hormone system by sending the wrong signals or by blocking naturally produced hormones.

Endocrine disruptors are common in the environment in plants that naturally produce phytoestrogens, in animal feed additives used to increase the rate of animal weight gain, in pharmaceuticals, in pesticides, and in various industrial processes and products. Endocrine disruptors are a concern because they are effective in extremely small doses (in the parts per trillion range) and can lead to a variety of health problems including but not limited to cancer, decreased fertility, abnormalities in newborns, and defects in reproductive organs (Kamrin 1999). Zondek and Sulman (1943, cited in Shore et al 1995) found that no common soil or fecal bacteria can metabolize estrogen. There are no chemicals used in HPP feedlot operations that are known to act as endocrine disruptors.

Some experts downplay the potential for adverse effects in humans, noting that the amounts found so far are in trace amounts, often in the parts per trillion range (Schaffer and Meersman 2002; Uehling 2001). They have been shown to adversely affect sexual morphology and function in fish, however (Raloff 2002), as well as other biota (USEPA 1997; Nichols et al 1997). Environmental estrogens have been implicated in the drastic sperm count reductions in Western men (Sharpe and Skakkebaek 1993, cited in Shore et al 1995) and in Nichols et al 1997).

The GEIS (Mulla et al 1999) notes that reports of such phenomena are increasing, but the cause and effect situation is poorly understood (see also Nichols et al 1997). The chemicals implicated may come from a variety of sources--not just feedlots--and may act synergistically. While it is known that land application of feedlot wastes can contribute estrogens to runoff (see for example Nichols et al 1997; Bushee et al 1998), and that elevated levels of these chemicals in water can adversely affect fish, birds, and other wildlife (Nichols et al 1997), “there is no evidence that livestock management [as an individual source] causes endocrine disruption in any fish or wildlife species” (Mulla et al 1999). Presumably, this conclusion would extend to humans as well, although this author did not specifically say so.

The literature surveyed for this EIS indicates that the bulk of endocrine disruptors originating at feedlots come from poultry, beef and dairy operations where steroids are used as growth and production promoters or are shed naturally from the animals themselves. As noted above, here are no chemicals used in HPP feedlot operations that are known to act as endocrine disruptors.

**Water Transmission of Disease**

Human health effects from exposure to nitrates of agricultural origin are well documented in the literature (for example, see Mulla et al 2001). The principle effect, methemoglobinemia ("blue baby syndrome") results from consumption of nitrates, generally in drinking water, resulting in
the displacement of oxygen in the bloodstream. Infants are most susceptible to the disease, hence the colloquial name. Since its initial identification in 1941, numerous cases of exposure have been documented, some as recently as the 1990s. Most of the cases resulted from ingestion of drinking water contaminated with nitrates.

Diseases transmitted via water are the most common. A list of pathogens is summarized in Table 3-8. Significant proportions of *Giardia* and *Cryptosporidia* infections are waterborne. These protozoa form cysts or oocysts that are resistant to disinfection (as via chlorination), and filtration systems are required to remove them from drinking water (Rosen 2000). Four *cryptosporidium* disease outbreaks in the U.S. have been linked to agricultural runoff. Other bacteria linked to waterborne disease include *Campylobacteria, Salmonella, E. Coli O157:H7, Leptospira, Yersinia*, and *Mycobacteria* (Mulla et al 2001).

Nearly all the viruses that cause gastroenteritis in humans have related strains that can cause diarrhea in livestock. Rotaviruses are the most common cause of severe diarrhea in humans worldwide and they are also a major cause of mortality in calves and piglets. Large numbers of viruses are excreted in an infected animal’s feces, and these viruses can enter water bodies through land application of animal wastes or by direct contamination from pastures and feedlots. However, these strains appear to be highly host specific. Although these animal viruses have been found in humans, they have not been documented as having an important role in human disease, either endemically or in outbreaks (LeBaron et al 1990).

**Soil-borne Transmission of Pathogens**

Some bacteria exhibit a low risk of being transmitted through water, including those that cause tetanus (*Clostridium tetani*), brucellosis (*Brucella abortus* (melitensis)), anthrax (*Bacillus anthracis*), and erysipelosis (*Erysipleas rhusiopathie*) (LeBaron et al 1990; Mulla et al 2001). There is a report of transmission of *E. coli O157:H7* through direct contact with soil, causing an outbreak of gastroenteritis in people attending a music festival held in fields previously used to graze cattle (Addis et al 1999). However, soil mediated disease that originates in feedlots may hinge more on the ability of pathogens to migrate through the soil to drinking water supplies than on direct human contact.

If liquid manure is applied by incorporation or injection into the soil, two major factors that control disease causation are survival time and ability to migrate through the environment. Pathogen survival depends on environmental factors and the type of pathogen. Visible light, ultraviolet radiation, and desiccation all can negatively affect pathogen survival in soil. The more protection from desiccation and ultraviolet light, the longer the pathogen will remain viable.

Pathogen movement tends to be inhibited in soil. While many pathogens are small enough to move with water through soil voids, clay particles and organic material effectively trap viruses,
bacteria and protozoa, as the pathogens are adsorbed to negatively charged surfaces. Larger pathogens are filtered by narrow soil pore sizes, although macropores and preferential pathways in soils can accelerate pathogen movement towards the ground water, and this may be exacerbated in granular soils. Soils with high nitrogen tend to extend the survivability of pathogens, particularly *E. coli* O157:H7. The additional nitrogen appears to allow cells to go through a period of progressive cell dormancy that prolongs their viability (Rosen 2000).

Most of the fields on which HPP manure is spread are composed of cohesive soils, which tends to bind pathogens and otherwise inhibit their movement in the environment. This will also be true on granular soils, although to a somewhat lesser degree; the organic material in the manure will tend to bind pathogens. Manure application on the surface (as at the Olson and Zeltwanger facilities) exposes any pathogens to environmental forces such as desiccation, heat, and sunlight, all of which tend to deactivate pathogens.

**Air-borne Transmission of Dust, Pathogens and Other Biologically Active Materials**

Dust is a common airborne irritant in animal confinement barns. The major components of dust are typically traced to feed, with additions from animal dander and hair, animal feces and urine, pathogens, and endotoxins (biologically active cell wall material from gram negative bacteria). Examples of diseases that could potentially be transmitted from an animal feedlot to humans through the air include anthrax, Q fever, brucellosis, influenza A, and histoplasmosis (Mulla *et al* 2001). Compounds such as ammonia, methane, and hydrogen sulfide may also attach to the dust particles and become airborne. The airborne matter may irritate or infect building workers, and also may be vented and released into the environment.

Dust concentrations in confinement buildings are affected by factors such as use of litter, animal husbandry practices, climate, and barn type. An EU-funded study that observed different types of barns for three different animals in four European countries found that dust concentrations are higher during the day and vary seasonally for hogs, being higher in the winter than in the summer (Takai *et al* 1997). However, viable respirable particles (endotoxins and pathogens) inside mechanically ventilated barns were almost twice the concentrations found inside naturally ventilated barns (Robarge *et al* 2000). A different study conducted in Kansas indicates that two similar barns, one mechanically ventilated and the other naturally ventilated, showed relatively little difference in dust concentrations between the two buildings. Mechanical ventilation versus natural ventilation did not impact dust concentrations in the Kansas study. However, the EU study suggests that the airflow exhaust locations, on sidewalls or endwalls versus roof exhaust, alter the airflow within barns, thus affecting dust concentration levels.

Emissions from confinement barns are affected by certain factors, including season, climate, ventilation system, type of barn, and type of animal housed within the barn. The EU study indicates that inhalable dust emission rates from barns were higher in winter because higher ventilation rates were used in the summer (Seedorf 1997). Travel distances of the emissions...
were not discussed. Local topography, weather, and ventilation system design also affect potential contaminant transmission. Dust emissions from hog barns are typically higher than dairy and cattle barns (Takai et al 1997).

In a pilot study conducted by Purdue University, bioaerosol (pathogens, endotoxins, and other biologically active substances) concentrations were measured in and up to 400 meters from a farrowing to finish swine facility. The purpose of the study was to determine the viability of bioaerosols at increasing distances from the barn. The results of the study indicated that at over 300 meters the total bacteria concentrations were low. However, it should be noted that the conditions during sampling were not conducive to airborne pathogen survival (Homes et al 1996). With the exception of soil borne bacteria such as anthrax, bacteria are typically not viable unless suspended in mist form from a liquid reservoir (Earth Tech 2001a).

While air emissions of the pathogens from animal confinement facilities increase the pathogen population in the environment, there are insufficient data to determine if this results in an increased risk to human health. Some studies indicate that there is no direct evidence that individuals living near large feedlots are at increased risk for developing diseases associated with contaminants transmitted via the air from these facilities. Other studies show workers and neighbors are most at risk, in terms of which segments of the population are most susceptible to health problems related to animal agriculture for airborne contaminants (Halverson 1999). Little research has been conducted on the emission rates of microorganisms from concentrated feedlots, and there is wide variation in the reported ranges of microorganism concentrations in air and emission rates from concentrated feedlots. Even less is known about the impact of these organisms on people living nearby (Earth Tech 2001b).

Vector-borne Transmission of Pathogens and Potentially Toxic Compounds

Insects, especially flies, are a potential vehicle for the transmission of human disease from manure, animal carcasses, and other animal wastes. Flies typically found in or near feedlots are house flies (Musca domestica), stable flies (Stomoxys calcitrans), fruit flies (family Brosophilidae), and blow flies (family Calliphoridae). These flies typically carry enteric disease-causing bacteria such as Salmonella spp. and Campylobacter jejuni. The GEIS discusses two studies indicating that enteric disease incidence decreases when fly presence in food preparation areas and food consumption areas (e.g. cafeterias, mess halls) is decreased. Disease incidence increases as proximity decreases among feces, flies and food (Addis et al 1999).

Bacteria causing food-borne illnesses could potentially be transmitted via flies from animal production facilities to human food and cause disease. This has not actually been documented, however. There have been several studies attempting to implicate flies as disease transmitting vectors (Earth Tech 2001a). However, flies have yet to be unambiguously documented as important contributors to incidence of diarrheal disease in communities around such facilities (Homes et al 1996; Addis et al 1999). Since pathogens are rapidly destroyed by desiccation,
ultra violet light, and other environmental factors, their viability may tend to decrease in the course of the first flight after acquisition (Addis et al 1999).

3.8 **GREENHOUSE GASES**

The discussion in this section is largely from Ciborowski (2003, MPCA, personal communication).

The term “greenhouse gases” collectively describes a group of gases that consist of carbon dioxide, methane, nitrous oxide, and other trace atmospheric gases. Greenhouse gases are produced from a variety of sources, the largest being industrial and commercial processes, transportation and agriculture. Greenhouse gases are thought to be the principal contributor to global warming. Greenhouse gases absorb energy in the infrared part of the electromagnetic spectrum. Once present in the atmosphere, they absorb a part of the long-wave radiation (heat) that the earth’s surface and lower troposphere radiate to space, essentially trapping it in the lower troposphere and causing global surface temperatures to rise. Most scientists who are actively engaged in research on the question of global warming believe that increasing atmospheric concentrations of greenhouse gases are causing an increase in global temperature. Some ecologists and wildlife biologists believe that global climate change could have substantial negative impacts on plant and animal populations worldwide. The principal debate among atmospheric scientists is not whether it will warm if greenhouse gas concentrations are substantially increased, but how much it will warm and how fast.

Methane (CH₄) and nitrous oxide (N₂O), two key greenhouse gases, are produced at, and emitted to the atmosphere from, swine feedlots (Oenema et al 1993; Nevison et al 1996; Li et al 2001; Lessard et al 1996; Chadwick et al 2000; Pierce 1999; Chang et al 1998; Monteny et al 2001; Flessa et al 2002). Carbon dioxide, another key greenhouse gas, is also produced at feedlots, but in relatively minor quantities. The primary source of carbon dioxide emissions to the atmosphere is fuel combustion (Flessa et al 2002).

Methane is produced during the decay of organic matter in swine manure storage facilities. The production of methane from manure requires the presence of anaerobic or reducing conditions such as are found in underbarn manure pits or outdoor tanks, lagoons and basins. Swine manure stored in below barn pits or basins is highly diluted with water, leading to the creation of anaerobic conditions within which methane production is enhanced. When manure is managed as a solid, methane production from it is minimal.

By contrast, nitrous oxide production in manure is minimal under anaerobic conditions; anaerobic conditions favor the further reduction of any produced nitrous oxide to nitrogen gas, which is not a greenhouse gas. Because most swine manure in Minnesota is managed as a dilute
slurry or liquid (e.g., total solids 2% or less), relatively little nitrous oxide is produced at swine feedlots, whereas substantial amounts of methane are produced on Minnesota feedlots.

Other sources of greenhouse gas emissions from swine feedlots include: swine flatulence, feedlot runoff, and land application of swine manure. Nitrous oxide is produced in soils by bacteria that convert ammonia to nitrate or that denitrify nitrate to N₂O. The application of swine manure to agricultural soils supply these bacteria with a nitrogen source needed for the production of nitrous oxide. The same bacterial processes produce nitrous oxide in surface waters and ground waters using run-off from feedlot surfaces and from soils as a nitrogen source. Finally, small amounts of methane are produced in the digestive tract of swine, and are emitted to the atmosphere as swine flatulate.

Most of the greenhouse gas emitted from swine feedlots in Minnesota is methane. An estimated total of 60,000 tons of methane are emitted from Minnesota swine feedlots each year. Most of this is derived from underbarn storage of manure; only about 15% is the result of swine flatulence. The emission of 60,000 tons of methane is equivalent to an emission of carbon dioxide of about 1.25 million tons. By contrast, the direct emission of nitrous oxide from swine feedlots is small, about 100 tons annually or, in terms of CO₂-equivalent emissions, about 30,000 CO₂-equivalent tons, which makes it small in relation to feedlot emissions of methane. To this one might add an additional emission of about 500 tons of N₂O (150,000 CO₂-equivalent tons) from the application of swine manure to agricultural fields in Minnesota and from runoff of manure nitrogen from field or feedlot surfaces.

An estimated 307,000 tons of methane (6.5 million CO₂-equivalent tons) are released to the atmosphere from all sources of emission in Minnesota. Emissions from livestock and emissions from manure stored on feedlots are the second and third largest methane emission sources in Minnesota, respectively, after solid waste landfills.

In all likelihood, no individual feedlot, including the HPP feedlots, contributes significantly to the greenhouse phenomenon. This is a cumulative type of impact, resulting from individual non-significant contributions from many sources, some human and some natural. The global warming problem is a global problem requiring a global solution. No single nation, state, or feedlot can solve the problem itself. Emission reductions at Minnesota feedlots would have no measurable effect on atmospheric methane levels. Long-term international and national efforts are underway to address this problem.

### 3.9 Site Specific Environmental Setting

**Water.** Descriptions of soil associations, surficial aquifer conditions, buried drift aquifer conditions, surface water proximity, and tile inlet locations at each of the Hancock Pro Pork facilities are presented below. **Figures 3-4a-c** illustrate the various soil associations present at
each of the land application field areas available to each of the Hancock Pro Pork facilities. **Figure 3-5b** illustrates interpreted ground water flow directions within the surficial aquifer, where present, beneath each of the Hancock Pro Pork facilities. **Figures 3-5d, 3-5g and 3-5j** illustrate interpreted ground water flow directions within buried drift aquifers beneath each of the Hancock Pro Pork facilities. **Figures 3-9 through 3-18** illustrate locations of surface water and tile inlets and wells at each of the Hancock Pro Pork facilities. **Table 3-9** presents a summary of the wells that are present within 1/2-mile of each of the project sites. **Table 3-10** presents a summary of environmental setting including tile inlets (TIs), aquifers, surface waters, or ecological or historic places on or near each site.

None of the regional wells in Swift, Stevens, or Pope counties contained nitrate levels above the Health Risk Limit of 10 ppm. This factor and the absence of any nitrate-stable conditions in the ground water chemistry data for the area suggest that nitrate-unstable conditions predominate within the project area.

In addition, although an investigation during September and October of 2000 that was conducted by the MPCA on three of the facilities in this EIS found nitrate impacts to the ground water above the HRL, only the Olson site could be conclusively shown to be contributing significant nitrate to the ground water. Further, as discussed above, natural attenuation limits the extent of potential impacts, due to an increase in reducing conditions in the ground water with increasing depth. All water samples collected from the farrowing facility and the Olson feedlot, with the exception of three, were collected at the water table. The three water samples collected at depth displayed the lowest nitrate (below method detection limit) and the most reducing conditions. These results suggest that stratification of the aquifer exists in the form of more reducing conditions with depth, indicating reduced potential for nitrate impacts with increasing depth. See **Section 3.3.2** for a more in-depth discussion.

**Air.** Information on the area’s climate and ambient air quality is given in **Section 3.1**. There are no schools, parks, churches, cemeteries, or other public access facilities within one mile of any of the HPP feedlots, except that the Charles barn, if built, would be within one mile of the city of Hancock. The only public structures or facilities near any of the sites are the public roadways near each site. The air impact analysis assesses the potential for impacts at facility fence lines and the nearest non-project neighbor.

### 3.9.1 Farrowing Facility

The environmental setting for the farrowing site is summarized in **Table 3-10**.

JD 9 is the only surface water located within 1 mile of the farrowing facility. This man-made waterway runs through several of the farrowing facility land application sites. Some of the forty-
three tile inlets (TIs) that drain the 1560 acres available for the facility's manure application, as identified in the facility's Manure Management Plan, drain into private ditches that connect to JD 9. The TIs may act as a direct connection from manure-applied fields to surface water.

Perimeter tile drains surround the five concrete manure pits. The perimeter tile drains are designed to intercept ground water if it rises near the base of the concrete pits. If ground water levels rise to the base of the concrete pits, the ground water will drain out of the perimeter tile and into the catch basins between the barns. The farrowing facility has testing protocols in place to test the water to determine if flow from the perimeter tile is impacted by a leak from a concrete pit should the perimeter tile begin to flow. The perimeter tiles have been reported to be dry since operation of the farrowing facility has begun. Storm water run off from the barn roofs and the facility's roads are directed toward a field tile to the northeast of the gestation barns.

The catch basins are grassed areas with slopes that direct water to the TI at its base. The farrowing facility has six catch basins and associated TIs. The locations of these TIs are shown on Fig. 2-4.

The TIs connect to a retention pond east of the facilities that drains to a field tile line northeast of the gestation barns. The latter discharges to a series of tile lines that eventually connect to JD 9.

Well logs located near the farrowing facility and its land application sites indicate that depth to ground water is approximately 10 feet and flows to the southeast. Well logs are located in Appendix E. The vertical gradient from the surficial aquifer is downward. Fifty-five (55) known wells are within a half-mile radius of the facility and the associated landspreading sites as shown on Figure 3-9. The surficial aquifer is present beneath the feedlot and almost all land application sites. The feedlot and all spreading fields contain granular soils.

### 3.9.2 Charles

The environmental setting of the Charles site is summarized in Table 3-10.

Page Lake is approximately one mile to the northeast of the Charles site. The locations of the TIs in the site's land application fields are shown on Figure 3-10.

If this site is built, a perimeter tile drain will surround the concrete pit beneath the barn. The perimeter tile will likely drain via overland flow to a vegetated area near the proposed barn site.

The grading around the concrete pit would direct storm water away from the pit. Storm water runoff from the barn roof is directed towards the adjacent fields and windbreak.
Ground water is at approximately 75 feet bgs near the feedlot. The surficial aquifer does not exist beneath the feedlot or any of the land application sites. The nearest aquifer is separated by cohesive soils. Eleven (11) known wells are within a half-mile radius as shown on Figure 3-10. Refer to Appendix E for individual well logs. No granular soils have been identified on the land application areas or the proposed feedlot.

3.9.3 Greiner

The environmental setting at the Greiner site is summarized in Table 3-10.

Surface waters in the area include Lake Emily (1/4 mile north of some land application fields) and a wetland within 1/2-mile of the eastern land application field. These waters are not located on Greiner land application sites. The fourteen TIs within the land application areas are reported to drain to road ditches (which are considered waters of the state, and thus subject to state water quality standards) or to wetlands nearby.

Perimeter tile drains surround the concrete pit beneath the hog barn. The Greiner site does not have protocols in place to test water when it flows from the tile. The perimeter tile drains via overland flow to a vegetated area near the barn.

The grading around the concrete pit directs the storm water away from the pit. Storm water run off from the barn roof is directed towards the adjacent fields. Driveway run off is directed towards the road ditch.

Well logs indicate ground water is approximately 50 feet from the surface near the Greiner feedlot. The surficial aquifer does not exist beneath the feedlot or any of the land application sites. Two (2) known wells are within a half-mile radius as shown on Figure 3-11. Refer to Appendix E for individual well logs. No granular soils were identified within the land application sites.

3.9.4 Nohl

The environmental setting of the Nohl site is summarized in Table 3-10.

There are no surface water bodies (other than road ditches and a partially open drainage ditch) within 1 mile of the land application fields or feedlot sites. The land application sites contain thirty-two TIs that connect to additional tile lines or private ditches that in turn connect to JD 9 over two miles away.

Perimeter tile drains surround the concrete pits beneath the hog barns. The Nohl site does not have testing protocols in place for use when water flows from this tile. The perimeter tile also
drains runoff from a vegetated area between the north and south barn that is drained by a TI. The TI is connected to a tile line that leads to the ditch to the north, which flows to JD 9.

The grading around the concrete pits directs storm water away from the pits towards the west. Storm water runoff from the barn roofs is directed towards the windbreak to the west. A catch basin between the barns and drainpipe assist in diverting water between the barns to the west.

Well logs indicate that ground water is within 10 feet of the surface near the Nohl site and its land application sites, and flows to the southeast. Twenty (20) CWI wells are within a half-mile radius as shown on Figure 3-12. Refer to Appendix E for individual well logs. The surficial aquifer is present beneath the feedlot and all of the land application sites. The feedlot and all of the land application sites contain granular soils.

3.9.5 Olson

The environmental setting of the Olson site is summarized in Table 3-10.

The land application sites contain two TIs that drains to an intermittent stream that leads to JD 9. JD 9 flows through the nearby land application fields.

The hogs on the Olson feedlot are allowed to enter and exit the barn onto open fenced lots. Clean water diversions exist around the open lots. The lots themselves drain directly to the nearest field. The north and east lots drain directly east and the south lot drains directly south, respectively. Grassed buffers exist between the lots and the field.

There are no concrete pits on the Olson site and no perimeter tiles.

Solid manure is hauled directly to the fields and incorporated within 12-96 hours during spring and fall application. During winter conditions it sometimes necessary to temporarily stockpile manure until field conditions are favorable for spreading. Manure applied during the winter is not incorporated until spring.

Ground water is approximately 10 feet from surface near the Olson site and its land application sites, and flows to the southeast. Twenty-one (21) known wells lie within a half-mile radius as shown on Figure 3-13. Five farm sites are also shown on this figure, but no wells for them show up on the CWI on in the DNR Permit database. The surficial aquifer is present beneath the feedlot and all of the land application sites. The feedlot and all of the land application sites contain granular soils.

3.9.6 Paul

The environmental setting of the Paul site is summarized in Table 3-10.
A wetland lies approximately 800 feet from the barn. The land application sites contain 30 TIs.

Perimeter tile surrounds the concrete pit beneath the hog barn. The Paul site does not have testing protocols in place for use when water flows from the tile during wet periods. The perimeter tile drains via overland flow to a grassy area near the barn. During the November 2001 MPCA inspection, the perimeter tile drained into the wetland. Paul was informed that this was not acceptable and subsequently changed the drainage.

The grading around the concrete pits directs storm water away from the pit. Storm water runoff from the barn roofs is directed towards the open vegetated areas between the barn and the road and east to additional open fields.

Ground water lies between 55-60 feet bgs near the feedlot and flows toward the Pomme de Terre River (southwest). Refer to Appendix E for individual well logs. The surficial aquifer is not present beneath the feedlot or any of the land application sites. The nearest aquifer is overlain by cohesive soils. Twelve known wells are within a half-mile radius as shown on Figure 3-14. No granular soils have been identified on the land application areas or at the feedlot.

3.9.7 Schaefer

The environmental setting of the Schaefer site is summarized in Table 3-10.

There are no surface waters (other than road ditches) identified on or within a half-mile radius of the feedlot site or land application fields. The feedlot and land application sites contain thirty-one TIs that drain to road ditches, join other tile lines, or outlet to fields.

Perimeter tile drains surround the concrete pits beneath the hog barns. The Schaefer site does not have testing protocols in place for use when water flows from the tile during wet periods. The perimeter tile sump drains to a tile line that flows north to a road ditch that outlets over one and half-miles away in a field not owned by Schaefer.

The grading around the concrete pits directs storm water away from the pits. A TI is located in a catch basin between the new barns and is connected to a tile line near the facility. Another TI lies in a grassy area between the new barns and the older barn. Storm water run off from the barn roofs is directed toward the catch basin or the adjacent fields in all directions.

Ground water is relatively close to the surface near the Schaefer site and its land application sites and flows to the south and southeast. Fourteen (14) known wells are within a half-mile radius as
shown on Figure 3-15. Refer to Appendix E for individual well logs. Ten farm sites are located in the same area, but no wells show up for them on the CWI. Well logs indicate that depth to water is approximately 10 feet. The surficial aquifer is present beneath all of the land application and feedlot sites. Approximately thirty percent of the land application sites contain granular soils. None were found to exist at the feedlot site.

3.9.8 Solvie

The environmental setting of the Solvie site is summarized in Table 3-10.

Surface waters in the area include the Chippewa River (less than 1/4-mile east of the eastern land application fields) and a wetland within 1/2-mile of the eastern land application field. The Chippewa River floodplain and the wetland are not located on Solvie land application sites. One TI is located within the area available for land application of manure. The TI outlets to the road ditch immediately adjacent to the property. The ditch eventually drains to a nearby unnamed wetland.

Perimeter tile drains surround the concrete pit. A sump pump discharges to a wooded area near the barns. The grading around the concrete pit directs storm water away from the pit. Storm water run off from the barn roofs is directed towards the adjacent fields and wooded area.

The Solvie feedlot is the only feedlot within the HPP project with sensitive habitat within a half-mile radius from its land application sites. Protected mussel habitats identified by the DNR NHNRNP near the banks of the Chippewa River are sensitive to increases in suspended solids.

The pre-existing barn that houses hogs from another source does not have a perimeter tile and uses a clay-lined basin for manure storage. The older barn has no pit storage or perimeter tile.

Well logs indicate ground water is approximately 7 feet from the surface near the Solvie feedlot. Twenty-five (25) known wells are within a half-mile radius as shown on Figure 3-16. There are also several irrigation wells in the area, and fourteen farm sites for which no CWI entries could be found. Refer to Appendix E for individual well logs. The surficial aquifer exists beneath portions of land available for land application of manure associated with the Solvie facility. Approximately 25% of the facility and associated land application acreage are within areas of granular soils, with approximately 75% in areas of cohesive soils.

3.9.9 Spohr

The environmental setting of the Spohr site is summarized in Table 3-10.
There are no surface waters other than road ditches identified on or within a half-mile radius of the feedlot site or land application fields. The land application fields contain twenty-nine TIs (in Section 36) that drain to road ditches to the west, and eventually outlet near the Pomme de Terre River.

Perimeter tile surrounds the concrete pit beneath the hog barn. The Spohr site does not have testing protocols in place for use when water flows from the tile during wet periods. The perimeter tile drains via overland flow to a road ditch that flows west.

The grading around the concrete pit directs the storm water away from the pit. Storm water run off from the barn and other facility building roofs is directed towards the adjacent fields. Driveway areas are gravel and drainage from these is directed towards nearby fields and the road ditch.

Ground water is approximately at 50-60 feet bgs near the feedlot and flows towards the Pomme de Terre River (southwest). The surficial aquifer does not exist beneath the feedlot or any of the land application sites. The nearest aquifer is separated from the surface by cohesive soils. Three Five (5) known wells are within a half-mile radius as shown on Figure 3-17. No granular soils have been identified on the land application areas or feedlot.

3.9.10 Zeltwanger

The environmental setting of the Zeltwanger site is summarized in Table 3-10. There are no surface waters other than road ditches identified on or within a half-mile radius of the feedlot site or land application fields. The closest surface water is Page Lake, approximately 1.5 miles to the northwest. The land application sites contain twenty-nine TIs that drain to road ditches or private ditches. In section 1, the four western-most TIs eventually flow to an intermittent stream that flows 1.5 miles south to a National Wildlife Management Area that eventually flows into JD 9. Zeltwanger’s remaining TIs in section 1 eventually lead to unnamed wetlands and/or other private ditches prior to flowing into the Chippewa River. The 14 TIs in sections 3 and 10 eventually flow into JD 9.

The site does not have concrete pits or perimeter tile drains.

Hogs on the Zeltwanger feedlot are kept in the barns and open lot areas. The areas near the barns and open lots are graded to minimize surface water run on. Driveways are gravel and drainage from these surfaces is directed towards the northwest to the adjacent fields. A concrete pad is used to stockpile manure when field conditions prevent direct haul for spreading. Runoff from this pad is directed north through vegetated areas to nearby fields.
Ground water lies approximately at 50-60 feet bgs near the feedlot and flows south and southwest. The surficial aquifer is not present beneath the feedlot or any of the land application sites. The nearest aquifer is separated from the surface by cohesive soils. Thirty-nine (39) known wells are within a half-mile radius as shown on Figure 3-18. No granular soils have been identified on the land application areas or feedlot.
ENVIRONMENTAL IMPACT OF PROJECT

The project operational details provided in Section 2.0 and the Environmental Setting data in Section 3.0 provide the information used to assess the environmental impact of each facility of the project. This assessment is supplemented by the air quality modeling completed by Gantzer Environmental, the findings of which are also summarized in this Section.

The environmental effects are assessed in the following areas of inquiry: air quality; surface water quality; ground water quality; ecological effects, public health, and socioeconomic effects. The section summarizes the positive effects or attributes of the project and the negative effects of the project that may require mitigation.

4.1 AIR QUALITY

Air quality impacts associated with the Hancock Pro-Pork Project were assessed by a two-step process. First, the emission rates of hydrogen sulfide (H₂S), ammonia (NH₃), and 14 volatile odorous organic compounds (VOOCs) were measured at each site. Second, air quality modeling by means of the CALPUFF computer model (see Section 4.1.1) estimated the property line and offsite concentrations of the emitted gases for each of the Hancock Pro-Pork sites. The major inputs for the air quality modeling effort were the measured onsite emission data, the size and location of each site’s livestock barns and manure storage facilities, and the 15 months of onsite weather data collected by the Minnesota Pollution Control Agency at the Hancock Pro-Pork farrowing site from July 30, 1999 to September 30, 2000. The hourly gas concentrations generated by the air quality model were compared to the target concentrations listed in Table 4-1 to determine the potential for impact. Adverse environmental impacts were considered to be possible when the estimated hourly property-line and off-site concentrations were above the listed target concentrations.

Livestock housing and manure storage facilities emit hydrogen sulfide, ammonia, and volatile odorous organic compounds (VOOCs) that can create odor episodes downwind of livestock operations (Earth Tech 2001). At least 168 individual VOOCs have been identified from liquid swine manure directly and from anaerobic headspace analysis of liquid manure (O’Neil and Phillips 1992). Field studies indicate that about 20 of these VOOCs are routinely found in the atmospheric gas plumes created by hog facilities. The atmospheric VOOCs are predominantly made up of volatile organic acids, phenolic compounds, and substituted heterocyclic compounds (Zahn 1997; Zahn et al 1997; Zahn et al 2001a).

In developing the methods used in this EIS analysis, Zahn (2001b) conducted field studies to determine simultaneously the atmospheric concentration of VOOCs and odor intensity in the field at 29 different hog production facilities. Odor intensity was measured by the method of direct scaling with reference to two odor standards. Away from the tested plume, the odor...
Panelists evaluated a 220 ppm (v/v) solution of n-butanol that was considered to have a neutral odor intensity (odor intensity = 3 out of a 10 scale) and a synthetic swine manure solution (Z2) that was considered to have an unpleasant odor intensity (odor intensity = 6.5 out of a 10 scale). The synthetic swine manure solution mimics the VOOC emissions from hog manure pits located beneath slatted hog barns. After exposure to the two reference odor intensities, the panelists were positioned 1.5-meters from the evaluated hog manure system and asked to compare the odor intensity with the two reference odor standards. Numerical evaluations of odor intensity ranged from neutral (3) to unbearable (10). During the odor intensity evaluation, air was drawn through multimedia sampling tubes. The VOOCs were desorbed from the tube media in the laboratory and analyzed by gas chromatography (Zahn et al 1997). (This is a description of the studies Zahn conducted to develop the methods that were used in this EIS analysis; it is not a description of the EIS analysis.)

Figure 4-1 illustrates the observed relationship between total VOOC concentration and odor intensity. Odor intensity and the logarithm (base 10) of the total VOOC concentration (µg/m³) in the air emitted from hog facilities were strongly correlated \((r^2=0.88)\). These results, and a comparison of the individual gas chromatograms, indicate that total VOOC concentration, rather than chemical diversity, defines odor intensity. This observation is important because odorant synergisms and antagonisms have been suggested as the most significant obstacle in applying chemical methods to odor measurement (Zahn et al 2001b). The field studies described above demonstrate that total VOOC concentration can be used to predict odor intensity associated with hog production sites.

While the target hydrogen sulfide and ammonia concentrations reflect either Minnesota ambient air quality standards or the inhalation Health Risk Values (iHRVs), the target concentrations for the aggregate concentration of the individual VOOCs were used to assess downwind odor intensities. As illustrated in Figure 4-1, a total VOOC (tVOOC) concentration of 10 µg/m³ approximately corresponds to a detectable swine odor with a “neutral” (not annoying) intensity. A tVOOC concentration of 70 µg/m³ approximately corresponds to an “unpleasant” (annoying) odor intensity. Detectability is interpreted from the graph.

The hydrogen sulfide, ammonia, and tVOOC concentrations generated by the air quality modeling were compared to the concentrations listed in Table 4-1 to assess the potential for environmental impacts. However, this comparison does not fully account for the one-half hour averaging time incorporated into the Minnesota hydrogen sulfide standard. The U.S. EPA air dispersion modeling guidelines (USEPA 1999a) do not provide for averaging times less than one hour. In contrast, the Minnesota ambient air quality standards for hydrogen sulfide are based on average concentrations over a 30-minute time period. Given this mismatch, and to be consistent
with past MPCA practice (and the only practical alternative), one-hour average model concentrations are compared to the Minnesota one-half hour H$_2$S standard.

With regard to odor, the direct scaling method used to develop **Figure 4-1** reflects an instantaneous measurement, which is also mismatched with the one-hour average model time period. This mismatch may have some consequences. For example, an odor intensity that an odor panelist may find to be merely detectable in an instantaneous field measurement could be annoying if present for an hour or longer.

The air quality modeling results are presented as maximum hourly concentrations, maximum 13-week time-averaged concentrations, or maximum annual average concentrations. While a maximum hourly hydrogen sulfide concentration at a site’s property line of 35 ppb suggests the potential for a site to exceed the ambient standard, the maximum concentration by itself does not in itself suggest a potential violation of the 30 ppb standard. To determine the potential for a violation, a time series analysis is need in which the frequency of modeled concentrations exceeding 30 or 50 ppb is examined. If the model-generated hourly concentrations at any point along a site’s property line exceed 30 ppb more than twice in any 5-day period, then the site is considered to have the potential to violate the 30 ppb standard. If the model-generated hourly concentrations at any property-line point exceed 50 ppb more than twice in any 365-day period, then the site is considered to have a potential violation of the 50 ppb standard.

### 4.1.1 Modeling Approach

The property-line and off-site atmospheric concentrations of hydrogen sulfide, ammonia, and tVOOC were estimated by use of the **CALPUFF** (version 5.5, level 010730) air quality model (USEPA 1995a Scire *et al* 2000). The **CALPUFF** model can model gas plumes under calm and near-calm wind conditions, which have been shown to be the conditions under which odors are most intense.

On-site weather data were used in estimating the property-line and off-site gas concentrations. The MPCA operated an air quality monitoring station and a meteorological station at the Hancock Pro-Pork farrowing site during parts of 1999 and 2000. The wind direction and wind speed data collected by the on-site weather station from July 30, 1999 to September 30, 2000 were collected every half hour. The hourly averaged wind speeds and wind directions were used in the **CALPUFF** modeling. The on-site weather station recorded wind speeds down to 1 mph (0.447 m/sec). Slower wind speeds were recorded as 0 mph. Air temperatures, atmospheric stability class, and rural mixing heights were determined from the surface weather data for the Minneapolis weather station and from upper air data for the Chanhassen weather station. The surface and upper air weather data sets were obtained from the National Climatic Data Center. The on-site wind data, the Minneapolis surface weather data, and the Chanhassen upper air data
were combined into an ISC (Industrial Source Complex) meteorological file. The atmospheric stability classes determined by PCRAMMET (USEPA 1999b) were corrected to reflect the on-site wind speeds. To allow use of the 1-mph wind speeds observed by the on-site station, the minimum wind speed allowed for non-calm conditions by CALPUFF was changed from the default of 0.5 m/sec to 0.4 m/sec.

Maximum one-hour average concentrations were calculated for each receptor. A receptor is a point at which CALPUFF estimates a gas concentration. Rural dispersion coefficients were used to characterize atmospheric mixing. The modeling was conservative (i.e. worst case), in that it assumed no deposition and assumed no decay of any modeled gas due to chemical reactions. The modeled receptor height was 0 meters, i.e. ground level. A flat terrain was assumed. All modeled receptors were defined as discrete receptors. Receptors were spaced along site property lines at 25-meter intervals. Local area modeling had a receptor spacing of 75 meters and covered a 3-mile by 3-mile grid with the modeled site located in the center square mile. Regional modeling had a receptor spacing of 500-meters and covered a 23-mile by 23-mile grid.

All gas emission sources were characterized as line sources, volume sources, or area sources. Livestock barns that are greater than 2 times longer than their width were modeled as line sources. Otherwise, the livestock barns were modeled as volume sources. Outdoor manure storage basins and treatment lagoons were modeled as area sources.

Long, naturally-ventilated livestock barns were modeled as line sources by means of the “approximate approach” described in U.S. EPA air quality modeling documentation (USEPA 1995b). Each barn was represented as a line of square volume subsources separated by a distance that was at least one-half the width of the modeled barn. The resulting square volume subsources were characterized in terms of their location, size, gas emission rate, release height, initial lateral dimension of the volume source, and the initial vertical dimension of the volume source. The sides of each square volume subsource were equal in length to the width of the finishing barn. The distance between the centers of the neighboring square volume subsources was calculated by the following equation:

\[
D = W + \frac{L - nW}{n - 1}
\]

in which \(D\) is the distance between volume subsource centers (ft), \(W\) is the width of the finishing barn (ft), \(L\) is the length of the finishing barn (ft), and \(n\) is the number of square volume subsources used to characterize the finishing barn. The second right-hand-side term in equation (4.1) is the distance between the sides of neighboring square volume subsources. The emission rate for each square volume subsource equaled the total emission rate for the finishing barn divided by the number of square volume subsources used to represent the barn. The source
height of the emitted gas equaled one-half the height of the barn. The initial lateral dimension was determined by the following equation:

\[ \sigma_{yo} = 0.3048 \frac{D}{2.15} \quad (4.2) \]

in which \( \sigma_{yo} \) is the initial lateral dimension of the volume subsource (m), \( D \) is the center-to-center distance between volume subsources (ft), and 0.3048 converts the units of feet into meters. The initial vertical dimension was obtained from the following equation:

\[ \sigma_{zo} = 0.3048 \frac{H}{2.15} \quad (4.3) \]

in which \( \sigma_{zo} \) is the initial vertical dimension of the volume subsource (m) and \( H \) is the height of the finishing barn (ft).

Short, naturally-ventilated barns were modeled as volume sources characterized by a single square volume subsource. The side length of the square volume subsource was calculated from the following equation:

\[ S = \sqrt{LW} \quad (4.4) \]

in which \( S \) is the side length (ft). The emission rate for single square volume subsource equaled the total emission rate for the entire barn. The source height of the emitted gas was equal to one-half the height of the barn. The initial lateral dimension was determined by the following equation (USEPA 1995b):

\[ \sigma_{yo} = 0.3048 \frac{S}{4.3} \quad (4.5) \]

in which \( \sigma_{yo} \) is the initial lateral dimension of the single volume subsource (m), \( S \) is the subsource side length (ft), and 0.3048 converts the units of feet into meters. The initial vertical dimension was obtained from equation (4.3).

Long, mechanically ventilated barns were also modeled as line sources using the “approximate approach” (equations 4.1 through 4.3), except the square subsources were characterized as potentially buoyant area sources instead of non-buoyant volume sources. For the Hancock farrowing site, the best fit between the observed and CALPUFF-generated hydrogen sulfide concentrations was obtained with an effective rise radius for each square area subsource of 1.6 meters and a rise velocity of 0.0001 m/sec based on the procedures described in U.S. EPA (1992).
Hydrogen sulfide, ammonia, and tVOOC emission rates were assigned to each modeled livestock barn and manure basin. Typically, at least one set of emission measurements was collected for each unique type of livestock barn on a Hancock Pro-Pork site. The only exceptions involved several older straw-pack barns and two barns with shallow pits that were empty of pigs when the barns were sampled (April-May 2001), but housed pigs during the November 2001 site visits. The tVOOC emission rates were determined by adding the emission rates for the 14 constituent volatile odorous organic compounds listed in Table 4-2.

The gas emission rates from the sampled hog barns were determined by multiplying the calculated airflow rate by the measured gas concentration:

\[ ER = GC \left( \frac{86400 \text{ sec}}{\text{day}} \right) \left( \frac{\text{gram}}{1 \times 10^6 \mu g} \right) \]  

in which \( ER \) is the emission rate for the sampled barn or room (g/day), \( G \) is the airflow rate (m³/sec), and \( C \) is the measured air-phase concentration (µg/m³). Airflow or ventilation rates were estimated by means of the carbon dioxide balance method. For the sampled curtain-sided and naturally-ventilated barns within which the air-phase could be considered completely mixed, the airflow rate was estimated by the following equation (Phillips et al 1998):

\[ G = \frac{P}{10^6(C_{CO2} - 369)} \]  

in which \( P \) is the carbon dioxide production rate for the housed pigs (m³/sec), and \( C_{CO2} \) is the measured carbon dioxide concentration within the barn (ppm, v/v). The atmospheric carbon dioxide concentration is 369 (ppm, v/v) (Keeling and Whorf 2001). Measured \( C_{CO2} \) concentrations less than 550 ppm were set equal to 550 ppm to prevent substantial overestimates of airflow rates (Phillips et al 1998). The carbon dioxide production rate was calculated assuming that 1 liter of carbon dioxide is produced per 24.6 kJ of total heat released by the housed animals. Total heat production values for various sizes and types of swine were interpolated from tabulated values (Albright 1990). The carbon dioxide balance approach was also used to estimate airflow rates in mechanically-ventilated rooms (Wood et al 2001), except plug-flow conditions were assumed.

Gas samples were typically sampled from the center of the hog barn or room. Carbon dioxide and ammonia concentrations were determined by means of colorimetric tubes (Sensidyne, Inc., Clearwater, FL). Hydrogen sulfide concentrations were measured with a Jerome Hydrogen Sulfide Analyzer (Arizona Instrument, Phoenix, AZ). Individual VOOC concentrations were determined by the method described in Zahn et al (1997). About 10 liters of air were drawn through multibed thermal desorption tubes. The tubes were sealed and shipped to the laboratory.
on dry ice. Analysis consisted of thermal desorption followed by gas chromatography. The methods used for VOOC sampling and analysis were similar to those used to measure the atmospheric concentrations of hazardous industrial volatile organic compounds (U.S. EPA, 1984; Lin, 2001).

Manure samples were collected from the deep pits at the new HPP barns on all sites. The temperature and pH were measured in the field by means of electronic probes. The total dissolved sulfide concentration was measured on a syringe-filtered sample by means of the methylene blue method (Hach Method 8131, which is equivalent to U.S. EPA Method 376.2). Frozen samples were sent to a laboratory for determination of volatile fatty acid, 4-AAP phenols, and ammonia concentrations. A second set of samples was sent to another laboratory for measurement of the individual VOOC concentrations. The solid phase microextraction (SPME) method described in Zahn et al (1997) was used to determine the individual VOOC concentrations by gas chromatography.

Ammonia emission rates for the hog barns were also estimated by means of the Battye et al (1994, Tables 2-1 and 2-9) “stable + manure” ammonia emission factors for pigs. The ammonia emission factors are 3.18 kg NH₃/head/yr for finishing pigs and 8.09 kg NH₃/head/yr for mature sows. The Battye et al ammonia emission factor for housed finishing pigs (3.18 kg NH₃/head/yr) is consistent with a recently determined value of 3.7 kg NH₃/head/yr for a tunnel-ventilated pull-plug finishing barn in North Carolina. Battye et al (1994) do not provide an ammonia emission factor for nursery pigs. However, an emission factor of 2.42 kg NH₃/head/yr for breeding sows of 20-50 kg is provided. This lower value was used as the ammonia emission factor for nursery pigs. The Battye emission factors represent ammonia emissions on an annual basis. To account for temperature variations on ammonia emissions from the pitted barns, the respective “stable + manure” ammonia emission factors were multiplied by the monthly scalars listed in Table 4-3.

The ammonia emission rates that were determined by the ammonia colorimetric tubes and estimated air exchange rates were always significantly less than the ammonia emission rates obtained from the Battye ammonia emission factors. Instantaneous ammonia emission measurements cannot capture the daily-average ammonia emission rates due to the diurnal changes in hog activity levels and elimination patterns. Hence, the ammonia emission rates for hog barns were based on the Battye ammonia emission factors so that the daily-average ammonia emission rates were incorporated into the air quality modeling.

The emission rate of hydrogen sulfide, ammonia, and VOOCs from the Solvie manure storage basin was calculated based on the dissolved concentration of the volatile chemical species and the overall mass transfer coefficient (WEF 1995).
in which $ER$ is the emission rate ($g/\text{day}$), $K$ is the overall mass transfer coefficient ($m/\text{sec}$), $A$ is the basin surface area ($m^2$), and $C$ is the water-phase concentration of the volatile chemical species ($g/m^3$). For example, while $C$ includes the dissolved hydrogen sulfide ($H_2S$) concentration, it does not include the bisulfide anion ($HS^-$) concentration. The U.S. EPA recommended algorithms that were used in estimating $K$ considered the Henry’s Law coefficient for the emitted gas, wind speed, and water temperature (USEPA 1994).

Hourly emission rates for hydrogen sulfide, ammonia, and tVOOC were generated (a CALPUFF BAEMARB.DAT file) based on the measured chemistry of the basin, the on-site hourly wind speed, and the hourly water temperature. Hourly temperatures for the modeled manure basin were estimated by the heat balance approach described in Thomann and Mueller (1987). The required hourly solar radiation inputs were estimated by use of the algorithms found in the U.S. EPA’s PCRAMMET program (USEPA 1999b).

Manure samples were collected from the Solvie manure basin, which is the only operational manure basin at a HPP facility. The temperature and pH were measured in the field by means of electronic probes. The total dissolved sulfide concentration was measured on a syringe-filtered sample by means of the methylene blue method (Hach Method 8131, which is equivalent to U.S. EPA Method 376.2). Frozen samples were sent to a laboratory for determination of volatile fatty acid, 4-AAP phenols, and ammonia concentrations. A second set of samples was sent to another laboratory for measurement of the individual VOOC concentrations. The solid phase microextraction (SPME) method described in Zahn et al (1997) was used to determine the individual VOOC concentrations by gas chromatography.

### 4.1.2 Site Specific Air Effects

The air quality impacts associated with each Hancock Pro-Pork site were assessed by comparing CALPUFF-generated property-line and off-site hydrogen sulfide, ammonia, and tVOOC concentrations to the threshold concentrations listed in Table 4-1. The CALPUFF-generated concentrations were based on the measured emission rates for hydrogen sulfide and tVOOC, published ammonia emission factors, and on-site wind velocities and directions. This approach examined the effect that only the Hancock Pro-Pork sites had on local air quality. The cumulative effect created by non-HPP unmodeled sources in combination with the modeled Hancock Pro-Pork sources was estimated by adding the background concentrations listed in Table 4-4 to the CALPUFF-generated concentrations.
Two sets of hourly hydrogen sulfide background concentrations were used. The first set consists of a 21-ppb background for the 30-ppb, 5-day hydrogen sulfide standard and a 32-ppb background for the 50-ppb, 1-year hydrogen sulfide standard. These values are the background concentrations observed at the Hancock Pro-Pork farrowing site and are considered appropriate for a distance of approximately 3 miles from the farrowing site (MPCA 2002). The Nohl, Olson, and Schaefer sites are located approximately 3 miles from the farrowing site, and these background values therefore apply to those sites as well. The second set of hourly hydrogen sulfide background concentrations consists of a 17-ppb background for the 30-ppb, 5-day hydrogen sulfide standard and an 18-ppb background for the 50-ppb, 1-year hydrogen sulfide standard. These values are the average background concentrations observed for several rural monitoring sites including the Hancock Pro-Pork farrowing site (MPCA 2002). This second set of hourly background concentrations was applied to the Charles, Greiner, Paul, Solvie, Spohr and Zeltwanger sites. This protocol is consistent with MPCA guidance for modeling feedlot emissions (MPCA 2002).

4.1.2.1 Farrowing Site

The Hancock Pro-Pork farrowing site consists of 5 hog barns located on about 19 acres of land. As illustrated in Figure 4-2, the property line setback distances for the farrowing site range from 151 to 295 feet. The site’s nearest neighbor is 1400 feet west of the site’s southwest corner. The dimensions and capacities of the 5 hog barns are provided in Table 4-5. Manure and gas samples were collected from the 3 gestation barns. Gas samples were collected from one room in the nursery barn and one room in the farrowing barn.

The gas emission rates calculated from the gas samples and from the Battye ammonia emission factors are provided in Table 4-6. No ammonia emissions were assigned to the piglets in the farrowing barn, because their individual weight (less than a maximum of 10-15 pounds) is well below the weights for the Battye emission factors. The listed barn emission rates indicate that the nursery is a large source of hydrogen sulfide, ammonia, and tVOOC emissions relative to the other barns.

The estimated maximum 1-hour property-line concentrations for the farrowing site are provided in Table 4-7. The CALPUFF modeling results suggest that the farrowing site has the potential to exceed and violate the 30 ppb Minnesota ambient air quality standards for hydrogen sulfide. The estimated maximum hydrogen sulfide concentrations exceed 30 ppb at the north (41.89 ppb) and south (30.01 ppb) property lines. When a background concentration of 21 ppb is added to the CALPUFF-generated concentrations, the 30 ppb hydrogen sulfide standard is predicted to be exceeded at all four property lines. Time-series analysis indicates that the CALPUFF concentrations without background along the property lines did not exceed 30 ppb more than twice within 5-day periods at any given receptor. However, with the 21-ppb background
concentration, at least 3 of the modeled 46 property-line receptors showed potential violations of the 30-ppb standard. The 30-ppb standard was violated 23 times for a receptor along the north property line (directly north of the nursery barn) and 21 times for a receptor along the south property line (directly south of the nursery barn). Thus, the CALPUFF results suggest potential violations of the 30-ppb hydrogen sulfide standard when the 21-ppb background concentration is added to the CALPUFF-generated concentrations.

The modeling also suggests the potential to exceed and violate the 50-ppb hydrogen sulfide standard. When a background concentration of 32 ppb is added to the CALPUFF-generated concentrations, the 50 ppb standard is exceeded at the north and south property lines (Table 4-7). Time-series analysis indicates no modeled violations of the 50 ppb standard without the 32-ppb background hydrogen sulfide concentration. However, with the 32-ppb background concentration, at least four of the modeled 46 property-line receptors showed potential violations of the 50-ppb standard. The 50 ppb standard was violated 28 times for a receptor along the north property line and 10 times for a receptor along the south property line.

The maximum 13-week property-line and nearest-neighbor hydrogen sulfide concentrations for the farrowing site are presented in Table 4-8. With and without a background concentration of 0.7 ppb, the nearest neighbor and all property-line concentrations are below the sub-chronic hydrogen sulfide iHRV of 7.1 ppb. Thus, the CALPUFF results suggest no on-site or off-site potential exceedances of the subchronic iHRV for hydrogen sulfide.

A comparison of the 25 highest hourly concentrations monitored by the MPCA CAM and the 25 highest hourly concentrations estimated by CALPUFF is provided in Figure 4-3. The CALPUFF-generated concentrations are for the location of the air quality monitor based on the 2001 emission measurements, reflecting the July 30, 1999 through September 30, 2000 on-site weather data. The monitored hourly hydrogen sulfide concentrations are for July 30, 1999 through September 30, 2000. The monitor data was screened for wind directions coming from the farrowing site. Figure 4-3 indicates that the CALPUFF results underestimated the CAM results by 0 to 2.5 ppb. Importantly, this indicates strong agreement between the CAM-measured concentrations and the concentrations predicted by the model at the CAM location.

The CAM data from July 1999 through September 2000 indicated no exceedances of the 30 ppb hydrogen sulfide standard, except during manure pit agitation and pumpout. However, caution should be used when citing this monitoring data as an example of compliance with the hydrogen sulfide standard. The air quality monitoring station was not located along the south property line at the location of the modeled highest hydrogen sulfide concentrations. The April 2001 emission measurements suggest that the nursery barn is the farrowing site’s largest hydrogen sulfide, ammonia, and tVOOC source. As illustrated in Figure 4-4, the CALPUFF results suggest that the highest hydrogen sulfide concentrations along the site’s south property line will be located...
directly south of the nursery. The modeling also suggests that the monitoring station is exposed to only about one-third of the maximum hydrogen sulfide concentrations estimated for the south property line.

The relationship between the maximum hourly hydrogen sulfide property-line concentration and the assumed uniform total dissolved sulfide concentration in the 5 manure pits located beneath the farrowing site’s hog barns was estimated by the PitEmissions software. All manure pits were assumed to have a manure temperature of 10.5°C, a manure pH of 7.22, and the same total dissolved sulfide concentration. As illustrated in Figure 4-5, the uniform total dissolved sulfide concentration must be below 4.3 mg S/L for the maximum hourly property line hydrogen sulfide concentration to be below 9 ppb (30 ppb with a 21-ppb background) based on the CALPUFF modeling results. This indicates that if the manure hydrogen sulfide concentration can be kept below 4.3 mg S/L, compliance at the fence line can be maintained.

The CALPUFF-generated maximum hourly property-line and nearest-neighbor ammonia concentrations for the farrowing site are provided in Table 4-9. The highest estimated property line concentration, with a background concentration of 148 µg/m³, is 2662 µg/m³, which is below the acute ammonia iHRV of 3200 µg/m³.

The CALPUFF-generated annual-average property-line and nearest-neighbor ammonia concentrations are provided in Table 4-10. With a background concentration of 5.72 µg/m³, the maximum annual property line concentration is 50.06 µg/m³ and the annual nearest neighbor concentration is 8.29 µg/m³, which are below the chronic ammonia iHRV of 80 µg/m³.

The CALPUFF-generated maximum hourly tVOOC concentrations for the farrowing site’s property lines and nearest neighbor are provided in Table 4-11. The maximum property line tVOOC concentration is 79.2 µg/m³, which is greater than the 70µg/m³ threshold for annoying odors and suggests the potential for the farrowing site to create annoying off-site odors. However, as illustrated in Figure 4-6, by the time an odorous plume reaches the site’s nearest neighbor its estimated intensity is reduced to a detectable, but non-annoying odor (i.e., the tVOOC is near 10 µg/m³). The CALPUFF-generated maximum nearest neighbor tVOOC concentration is 5 times less than the tVOOC concentration associated with “unpleasant” odor intensities.

The CALPUFF-generated off-site concentrations of hydrogen sulfide, ammonia, and tVOOC are provided in Figures 4-7, 4-8, and 4-9, respectively. The modeling results indicate that the farrowing site can be responsible for hydrogen sulfide concentrations of 10 ppb (31 ppb with background) up to 0.5 miles from the site. Detectable non-annoying odors (tVOOC concentrations greater than 10 µg/m³) can persist for up to 0.8 miles from the site.
4.1.2.2 Charles Site

If built, the Charles site would consist of a single hog-finishing barn located on about 300 acres of land. As illustrated in Figure 4-10, the property line setback distances for the site range from 368 to 3800 feet. The site’s nearest neighbor is located about 1400 feet west of the proposed hog barn. The dimensions and capacity of the single finishing barn are provided in Table 4-12.

Because the barn is not built, the potential emissions for the site were assumed equal to the average measured hydrogen sulfide, ammonia, and tVOOC emission rates for the curtain-sided, deep-pitted finishing barns at the other HPP sites. The average measured emission rates and the ammonia emission rate obtained from the Battye emission factors are provided in Table 4-13.

The CALPUFF results suggest that the pending Charles hog-finishing site will comply with the Minnesota ambient air quality standard for hydrogen sulfide. The estimated maximum hourly property line and nearest neighbor concentrations for the proposed site are provided in Table 4-14 and are below 30 ppb. When a background concentration of 17 ppb (v/v) is added to the CALPUFF-generated concentration, the maximum estimated property-line hydrogen sulfide concentration is 22.76 ppb, which is below the standard of 30 ppb. As illustrated in Table 4-15, the CALPUFF-generated maximum 13-week property-line and nearest-neighbor concentrations are below the sub-chronic iHRV of 7.1 ppb.

The PitEmissions software estimated the relationship between the maximum hourly hydrogen sulfide property-line concentration and the total dissolved sulfide concentration in the proposed barn’s manure pit. The manure pit was assumed to have a manure temperature of 10.5°C and a manure pH of 7.22. As illustrated in Figure 4-11, the total dissolved sulfide concentration must be below 22.3 mg S/L for the maximum hourly property-line hydrogen sulfide concentration to be below 13 ppb (30 ppb with a 17-ppb background) based on the CALPUFF results.

The maximum hourly time-averaged property-line ammonia concentrations that were estimated by the CALPUFF model are provided in Table 4-16. The highest estimated property-line concentration with a background concentration of 148 µg/m³ is 1024 µg/m³, which is below the acute ammonia iHRV of 3200 µg/m³. Thus, modeled ammonia emissions from the proposed Charles hog-finishing site are not predicted to cause an exceedance of the acute ammonia iHRV. As illustrated in Table 4-17, the CALPUFF-generated annual-average property-line and nearest-neighbor ammonia concentrations are below the chronic ammonia iHRV of 80 µg/m³.

The CALPUFF-generated maximum hourly tVOOC concentrations for the Charles site’s property lines are provided in Table 4.18. The maximum property-line tVOOC concentration is 20.7 µg/m³, which is less than the 70µg/m³ threshold for annoying odors and suggests that the Charles will not create annoying off-site odors. As illustrated in Figure 4-12, the maximum
property-line tVOOC concentration is 3.4 times less than the annoying odor threshold and the maximum nearest-neighbor tVOOC concentration is 12.5 times less than the annoying odor threshold of 70 µg/m³.

The CALPUFF-generated off-site concentrations of hydrogen sulfide, ammonia, and tVOOC are provided in Figures 4-13, 4-14, and 4-15, respectively. The graphs indicate that detectable non-annoying concentrations of hydrogen sulfide (concentrations greater than 3.7 ppb) and tVOOC (concentrations greater than 10 µg/m³) may exist off-site under certain weather conditions.

4.1.2.3 Greiner Site

The Greiner site consists of a single 208-foot by 41-foot hog-finishing barn. No hog barns were on the site prior to the formation of HPP. As illustrated in Figure 4-16, the property line setback distances for the site range from 121 to 4640 feet. The site’s nearest neighbor is located about 1-mile west-southwest of the finishing barn. The dimensions and capacity of the single finishing barn are provided in Table 4-19. The measured emission rates and the ammonia emission rate obtained from the Battye emission factors are provided in Table 4-20.

The CALPUFF modeling results suggest that the Greiner hog-finishing site will not exceed the 30-ppb Minnesota ambient air quality standard for hydrogen sulfide. The estimated maximum hourly property-line concentrations for the Greiner site are provided in Table 4-21. When a background concentration of 17 ppb (v/v) is added to the CALPUFF-generated concentration, the maximum estimated property-line hydrogen sulfide concentration is 27.95 ppb (v/v), which is below the standard of 30 ppb, v/v. Also, the CALPUFF-generated maximum 13-week property-line concentration is below the sub-chronic iHRV of 7.1 ppb.

CALPUFF and the PitEmissions software were used to estimate the relationship between the maximum hourly hydrogen sulfide property-line concentration and the uniform total dissolved sulfide concentration in the manure pit. The manure pit was assumed to have a manure temperature of 10.5°C and a manure pH of 7.22. As illustrated in Figure 4-17, the total dissolved sulfide concentration must be below 11.8 mg S/L in both manure pits for the maximum hourly property-line hydrogen sulfide concentration to be below 13 ppb (30 ppb with a 17-ppb background).

The maximum 1-hour time-averaged property-line ammonia concentrations that were estimated by the CALPUFF model are provided in Table 4-23. The highest estimated property-line concentration with a background concentration of 148 µg/m³ is 1803 µg/m³, which is below the acute ammonia iHRV of 3200 µg/m³. Thus, the modeling results suggest that the Greiner site does not exceed the acute ammonia iHRV. As illustrated in Table 4-24, the CALPUFF-
generated annual-average property-line and nearest-neighbor ammonia concentrations are below the chronic ammonia iHRV of 80 µg/m³.

The *CALPUFF*-generated maximum hourly tVOOC concentrations for the Greiner site’s property lines are provided in Table 4-25. The maximum tVOOC concentration for the east property line is 54 µg/m³, which is below the annoying odor threshold of 70 µg/m³. As illustrated in Figure 4-18, the maximum nearest-neighbor tVOOC concentration of 1.22 µg/m³ is 57 times less than the annoying odor threshold.

The *CALPUFF*-generated off-site concentrations of hydrogen sulfide, ammonia, and tVOOC are provided in Figures 4-19, 4-20, and 4-21, respectively. The graphs indicate that detectable non-annoying concentrations of hydrogen sulfide (concentrations greater than 3.7 ppb) may exist off-site. Detectable non-annoying odors (tVOOC concentration greater than 10 µg/m³) may persist for up to 1500 feet from the site. Since the nearest neighbor is a mile away, the modeling thus suggests that the Greiner site would not cause significant odor impacts at receptors.

4.1.2.4 Nohl Site

The Nohl site consists of two hog-finishing barns located on a 6-acre parcel of land. No hog barns were on the site prior to the formation of HPP. As illustrated in Figure 4-22, the property line setback distances for the site range from 22 to 401 feet. The dimensions and capacities of the two finishing barns are provided in Table 4-26. The hydrogen sulfide, ammonia, and tVOOC emission rates were measured for the north finishing barn. The emission rates for the south finishing barn were assumed to be 95 percent of the north finishing barn, which is the ratio of the barn surface areas. The emission rates for the two barns are provided in Table 4-27.

The *CALPUFF*-generated property-line hydrogen sulfide concentrations for the Nohl site are provided in Table 4-28. When a background concentration of 21 ppb (v/v) is added to the *CALPUFF*-generated concentrations, the maximum property-line hydrogen sulfide concentrations exceed the 30-ppb standard along the south and west property lines. Time-series analysis indicated that the *CALPUFF*-generated concentrations with the 21 ppb background did not exceed 30 ppb more than twice within any 5-day period at any of the modeled property-line receptors. Thus, the modeled hydrogen sulfide emissions from the Nohl site have the potential to exceed, but not violate, the 30 ppb standard. As illustrated in Table 4-29, the *CALPUFF*-generated maximum 13-week property-line and nearest-neighbor concentrations are below the sub-chronic hydrogen sulfide iHRV of 7.1 ppb.

*CALPUFF* and the *PitEmissions* software were used to estimate the relationship between the maximum hourly hydrogen sulfide property-line concentration and the uniform total dissolved sulfide concentration in the site’s two manure pits. The manure pits were assumed to have a
manure temperature of 10.5°C and a manure pH of 7.22. As illustrated in Figure 4-23, the total dissolved sulfide concentration must be below 6.0 mg S/L for the maximum hourly property-line hydrogen sulfide concentration to be below 9 ppb (30 ppb with a 21-ppb background).

The maximum hourly time-averaged property-line ammonia concentrations that were estimated by the CALPUFF model are provided in Table 4-30. The highest estimated property-line concentration with a background concentration of 148 µg/m³ is 2352 µg/m³, which is below the acute ammonia iHRV of 3200 µg/m³. Thus, the modeling results suggest that the Nohl site does not exceed the acute ammonia iHRV. As illustrated in Table 4-31, the CALPUFF-generated annual-average property-line and nearest-neighbor ammonia concentrations are below the chronic ammonia iHRV of 80 µg/m³.

The CALPUFF-generated maximum hourly tVOOC concentrations for the Nohl site’s property lines and nearest neighbor are provided in Table 4-32. The maximum tVOOC concentration for the south property line is 49 µg/m³, which is below the annoying odor threshold of 70 µg/m³. As illustrated in Figure 4-24, the maximum nearest-neighbor tVOOC concentration of 3.39 µg/m³ is 20 times less than the annoying odor threshold.

The CALPUFF-generated off-site concentrations of hydrogen sulfide, ammonia, and tVOOC are provided in Figures 4-25, 4-26, and 4-27, respectively. The off-site graphs illustrate that the CALPUFF-generated hydrogen sulfide concentrations greater than 6 ppb (without background) are limited to areas that are within a few hundred feet of the Nohl hog site. Total volatile odorous organic compound (tVOOC) concentrations are reduced to detectable, non-annoying levels (10 µg/m³) within 1500 feet of the Nohl hog site.

4.1.2.5 Olson Site

The Olson site consists of three hog-finishing barns on about 154 acres of land. The same three barns were present before the formation of HPP. As illustrated in Figure 4-28, the property line setback distances for the site range from 162 to 2184 feet. The dimensions and capacities of the three straw-pack finishing barns are provided in Table 4-33. The hydrogen sulfide, ammonia, and tVOOC emission rates were measured for the south barn. The emission rates for the north and middle barns were calculated based on their floor surface areas relative to the south barn. The emission rates for the three barns are provided in Table 4-34.

The CALPUFF modeling results suggest that the Olson hog-finishing site complies with the Minnesota ambient air quality standard for hydrogen sulfide. The estimated maximum hourly property-line and nearest-neighbor concentrations for the Olson site are provided in Table 4-35. When a background concentration of 21 ppb (v/v) is added to the CALPUFF-generated concentrations, the maximum estimated property-line hydrogen sulfide concentration is
24.15 ppb (v/v), which is below the ambient standard of 30 ppb. As illustrated in Table 4-36, the CALPUFF-generated maximum 13-week property-line and nearest-neighbor concentrations are below the sub-chronic hydrogen sulfide iHRV of 7.1 ppb.

The estimated maximum hourly time-averaged property-line ammonia concentrations are provided in Table 4-37. The highest estimated property-line concentration with a background concentration of 148 µg/m³ is 776 µg/m³, which is below the acute ammonia iHRV of 3200 µg/m³. Thus, the modeling results suggest that the Olson site does not exceed the acute ammonia iHRV. As illustrated in Table 4-38, the CALPUFF-generated annual-average property-line and nearest-neighbor ammonia concentrations are below the chronic ammonia iHRV of 80 µg/m³.

The CALPUFF-generated maximum hourly tVOOC concentrations for the Olson site’s property lines are provided in Table 4-39. The maximum property-line concentration is 20.41 µg/m³ at the north property line. Thus, the modeling suggests detectable (non-annoying) swine odors can exist at the site’s north property line. As illustrated in Figure 4-29, the estimated maximum nearest-neighbor tVOOC concentration of 2.67 µg/m³ is 26 times less than the annoyance odor threshold of 70 µg/m³.

The CALPUFF-generated off-site concentrations of hydrogen sulfide, ammonia, and tVOOC are provided in Figures 4-30, 4-31, and 4-32, respectively. The off-site graph for tVOOC suggests the potential for detectable (non-annoying) swine odors to exist up to 250-ft north of the Olson site.

4.1.2.6 Paul Site

The Paul site consists of a single 208-foot by 41-foot curtain-sided finishing barn located on about 154 acres of land. No hog barns were on the site prior to the formation of HPP. As illustrated in Figure 4-33, setback distances from the site’s property lines range from 188 to 2333 feet. The nearest residence is rental property on the Paul property and is located about 1400 feet northeast of the hog-finishing barn. The dimensions and capacity of the site’s single finishing barn are provided in Table 4-40. The measured emission rates and the ammonia emission rate obtained from the Battye emission factors are provided in Table 4-41.

The CALPUFF-generated property-line and nearest-neighbor hydrogen sulfide concentrations for the Paul site are provided in Table 4-42. When a background concentration of 17 ppb (v/v) is added to the CALPUFF-generated concentrations, the maximum estimated property-line hydrogen sulfide concentration is 28.15 ppb, which is below the 30 ppb standard. As provided in Table 4-38, the CALPUFF-generated maximum 13-week property-line and nearest-neighbor concentrations are below the sub-chronic iHRV of 7.1 ppb.
CALPUFF and the PitEmissions software were used to estimate the relationship between the maximum hourly hydrogen sulfide property-line concentration and the total dissolved sulfide concentration in the barn’s manure pit. The manure pit is assumed to have a manure temperature of 10.5°C and a manure pH of 7.22. As illustrated in Figure 4-34, the total dissolved sulfide concentration must be below 16.02 mg S/L for the maximum hourly property-line hydrogen sulfide concentration to be below 13 ppb (30 ppb with a 17-ppb background).

The estimated maximum hourly property-line and nearest-neighbor ammonia concentrations are provided in Table 4-44. The highest estimated property-line concentration with a background concentration of 148 µg/m³ is 1072 µg/m³, which is below the acute ammonia iHRV of 3200 µg/m³. Thus, the modeling results suggest that the Paul site does not exceed the acute ammonia iHRV. As provided in Table 4-45, the CALPUFF-generated annual property-line and nearest-neighbor ammonia concentrations are below the chronic ammonia iHRV of 80 µg/m³.

The CALPUFF-generated maximum hourly tVOOC concentrations for the Paul site’s property lines are provided in Table 4-46. The maximum property-line concentration is 28.55 µg/m³, which is above the 10 µg/m³ detection threshold and below the 70 µg/m³ annoyance threshold. As illustrated Figure 4-35, the maximum nearest-neighbor tVOOC concentration of 7.29 µg/m³ is about 9 times less than the annoyance threshold concentration.

The estimated off-site concentrations of hydrogen sulfide, ammonia, and tVOOC are provided in Figures 4-36, 4-37, and 4-38, respectively. The graphs indicate that detectable non-annoying concentrations of hydrogen sulfide (concentrations greater than 3.7 ppb) and tVOOC (concentrations greater than 10 µg/m³) may exist off-site under certain weather conditions. Figure 4-38 suggests the existence of detectable non-annoying tVOOC plumes that extend 1000-feet beyond the site’s south property line.

4.1.2.7 Schaefer Site

The Schaefer site currently consists of three small hog barns and two 208-foot by 41-foot hog-finish barns on about 120 acres of land. The construction of the latter two barns is associated with the formation of HPP. The construction of a third 208 foot by 41 foot finishing barn was proposed, but is currently not being considered. The proposed third finishing barn would be located about 80 feet south of the existing south finishing barn. In addition to modeling the property-line and nearest-neighbor gas concentrations for the exiting two barns, the local air quality impacts potential associated with construction of the proposed third finishing barn was examined. As illustrated in Figure 4-39, the property-line setback distances for the existing barns range from 20 to 1794 feet. The site’s nearest neighbor is located about 900 feet northwest of the three small hog barns. The dimensions and capacities of the site’s currently existing hog barns and the one proposed barn are provided in Table 4-47. When the emission measurements
were conducted in May 2001, the three small barns were not being used and, hence, the emission rates for the three small barns were not measured. The hydrogen sulfide, ammonia (measured), and tVOOC emission rates for the three small barns were calculated based on the average emission flux rates observed for the Olson and Zeltwanger straw-pack barns. The hydrogen sulfide, ammonia (measured), and tVOOC emission rates for the proposed third finishing barn were assumed to be the average of the values for the existing north and south finishing barns. The measured and calculated emission rates for the five existing Schaefer barns and the proposed third finishing barn are provided in Table 4-48.

The *CALPUFF*-generated hourly property-line hydrogen sulfide concentrations for the Schaefer site before and after construction of the two 208-foot by 41-foot finishing barns are provided in Table 4-49. Prior to the construction of the two 208-foot by 41-foot barns, the highest *CALPUFF*-generated concentration with a background of 21 ppb is 23.92 ppb, which is below the ambient standard of 30 ppb. After construction of the two barns, maximum *CALPUFF*-generated property-line concentration of 17.01 ppb is predicted at the west property line. When a background concentration of 21 ppb (v/v) is added to the *CALPUFF*-generated concentrations, the maximum estimated hydrogen sulfide concentrations for the west and north property lines exceed 30 ppb. A time-series analysis indicates that the predicted hydrogen sulfide concentrations along west property line may violate the 30-ppb, 5-day standard (more than 2 exceedances of 30 ppb within any 5-day period). No violations were predicted for the north property line. As illustrated in Table 4-50, the *CALPUFF*-generated maximum 13-week property-line and nearest-neighbor concentrations for the existing barns are below the sub-chronic iHRV of 7.1 ppb.

If the proposed finishing barn is built, then the *CALPUFF* results suggest potential violations of the 30-ppb hydrogen sulfide standard along both the west and north property lines. The *CALPUFF*-generated maximum hourly property-line and nearest-neighbor hydrogen sulfide concentrations associated with the construction of the north, south, and proposed third finishing barns are provided in Table 4-51. With a background concentration of 21 ppb, the maximum hourly hydrogen sulfide concentrations for the west and north property lines are 40.03 and 35.21 ppb, respectively. A time-series analysis indicate that hydrogen sulfide concentrations greater than 30 ppb (with background) would occur more than twice within several five-day periods for the west and north property lines. While the west property line has the predicted potential to exceed 50 ppb with a background concentration of 32 pp, time-series analyses showed no predicted violations of the 50-ppb, 1-year standard. As illustrated in Table 4-52, the *CALPUFF*-generated maximum 13-week property-line and nearest-neighbor concentrations with the construction of the north, south, and proposed third finishing barns are below the sub-chronic iHRV of 7.1 ppb.
CALPUFF and the PitEmissions software were used to estimate the relationship between the maximum hourly hydrogen sulfide property-line concentration and the uniform total dissolved sulfide concentration in the manure pits located beneath the north and south finishing barns. In this analysis, the hydrogen sulfide emissions from the three small barns were assumed to have an insignificant effect on west property-line hydrogen sulfide concentrations. The two manure pits were assumed to have a manure temperature of 10.5°C and a manure pH of 7.22. As illustrated in Figure 4–40, the total dissolved sulfide concentration in the two existing manure pits must be below 6.4 mg S/L for the maximum hourly west property-line hydrogen sulfide concentration to be below 9 ppb (30 ppb with a 21-ppb background). If the proposed finishing barn were built, then the required uniform total dissolved sulfide concentration for the resulting three manure pits would drop to 5.1 mg S/L.

The maximum 1-hour time-averaged property-line ammonia concentrations that were estimated by the CALPUFF model for before and after construction of the existing two 208-ft by 41-ft barns are provided in Table 4-53. Before construction, the highest estimated property-line concentration with a background concentration of 148 µg/m³ is 872 µg/m³, which is below the acute ammonia iHRV of 3200 µg/m³. After construction, the highest estimated property-line concentration with a background concentration of 148 µg/m³ is 2212 µg/m³, which is also below the acute iHRV for ammonia. Thus, the modeling results suggest that the Schaefer site continues to have property-line ammonia concentrations below the acute ammonia iHRV. If the proposed finishing barn were built, then the estimated maximum property-line ammonia concentration with background is 2322 µg/m³ (Table 4-54). As illustrated in Table 4-55, the CALPUFF-generated annual-average ammonia concentrations along all property lines and at the nearest neighbor are below the chronic ammonia iHRV of 80 µg/m³. This remains the case if the proposed finishing barn were to be built (Table 4-56).

The CALPUFF-generated property-line and nearest-neighbor tVOOC concentrations before and after construction of the existing two 208-ft hog barns are provided in Table 4-57. Without the two barns, the maximum estimated tVOOC concentration is 13.41 µg/m³. With the two barns, the maximum estimated tVOOC concentration is 83.55 µg/m³ along the west property line, which represents an annoying swine odor. As illustrated Figure 4-41, the maximum nearest-neighbor tVOOC concentration of 36.06 µg/m³ is about one-half the annoyance threshold concentration of 70 µg/m³. If the proposed finishing barn were to be built, the estimated maximum tVOOC concentrations for the west property line and the site’s nearest neighbor are 85.95 and 48.88 µg/m³, respectively (Table 4-58). Thus, the modeling suggests that the Schaefer site (with two or three barns) can create annoying off-site odors along the west property line, but that annoying odors do not reach the nearest neighbor.
The *CALPUFF*-generated off-site concentrations of hydrogen sulfide, ammonia, and tVOOC representing the local air quality before the construction of the 208-foot barns are provided in Figures 4-42, 4-43, and 4-44, respectively. The off-site graph for tVOOC suggests the potential for detectable (non-annoying) swine odors to persist for about 200 feet beyond the site’s west property line.

The *CALPUFF*-generated off-site concentrations of hydrogen sulfide, ammonia, and tVOOC representing the local air quality after the construction of the existing two 208-foot barns are provided in Figures 4-45, 4-46, and 4-47, respectively. The off-site graph for tVOOC suggests the potential for detectable (non-annoying) swine odors to persist for up to 2000 feet beyond site’s west property line.

The estimated off-site concentrations of hydrogen sulfide, ammonia, and tVOOC assuming the subsequent construction of the proposed finishing barn are provided in Figures 4-48, 4-49, and 4-50. With the three 208-foot finishing barns, the modeling suggests the potential for tVOOC concentrations greater than 70 µg/m³ (annoying swine odors) to exist up to 250 feet beyond the site’s west property line.

4.1.2.8 Solvie Site

As shown in Figure 4-51, the Solvie site currently consists of three hog barns and one manure basin located on about 300 acres of land. The old barn is a 138-foot by 36-foot straw-pack barn. The south finishing barn is a 160-foot by 41-foot curtain-sided barn with a shallow manure pit that drains into the 140-foot by 110-foot manure basin. The north finishing barn is a 208-foot by 41-foot curtain-sided barn with a deep manure storage pit. The construction of the north finishing barn is associated with the formation of HPP. The present property line setback distances range from 609 to 3451 feet. The nearest off-site neighbor is located about 1700 feet west of the site. The dimensions and capacities of the three barns are provided in Table 4-59. The emission rates of both the north and south finishing barns were measured. The emission rates for the old barn were calculated based on the average emission fluxes observed for the Olson and Zeltwanger straw-pack barns. The measured and calculated emission rates for the three Solvie barns are provided in Table 4-60.

The estimated hydrogen sulfide, ammonia, and tVOOC emission rates for the manure basin varied hourly with changes in wind speed and air temperature. The basin emission rates were based on the measured chemical parameters of basin samples collected on May 4, 2001. The estimated noon-hour basin water temperatures from July 30, 1999 through September 30, 2000 are provided in Figure 4-52. When the estimated water temperature dropped to 0°C and below, the basin was assumed to have an ice cover and gas emission rates went to zero. The calculated
noon-hour hydrogen sulfide, ammonia, and tVOOC emission flux rates for the Solvie manure basin are provided in Figures 4-53, 4-54, and 4-55, respectively.

The CALPUFF-generated property-line hydrogen sulfide concentrations for the Solvie site before and after construction of the north finishing barn are provided in Table 4-61. Prior to the construction of the north finishing barn, the highest CALPUFF-generated concentration with a background of 17 ppb is 39.14 ppb, which is above the ambient standard of 30 ppb. After construction of the north finishing barn, the highest CALPUFF-generated concentration with a background of 17 ppb is 39.33, which is also above the ambient standard of 30 ppb. A time-series analysis indicates that the occurrences of hydrogen sulfide concentrations greater than 30 ppb (with background) at points along the south property line do not occur within any 5-day period. While the modeling results indicate maximum property-line hydrogen sulfide concentrations greater than 30 ppb, the modeling results do not indicate violations of the 30 ppb standard. As illustrated in Table 4-62, the CALPUFF-generated maximum 13-week property-line and nearest-neighbor concentrations are below the sub-chronic iHRV of 7.1 ppb.

The maximum hourly time-averaged property-line ammonia concentrations that were estimated by the CALPUFF model for before and after construction of the north finishing barn are provided in Table 4-63. Before construction, the highest estimated property-line concentration with a background concentration of 148 µg/m³ is 1037 µg/m³, which is below the acute ammonia iHRV of 3200 µg/m³. After construction, the highest estimated property-line concentration with a background concentration of 148 µg/m³ is 1409 µg/m³, which is also below the acute iHRV for ammonia. Thus, the modeling results suggest that the Solvie site continues to have property-line ammonia concentrations below the acute ammonia iHRV. As illustrated in Table 4-64, the CALPUFF-generated annual-average ammonia concentrations along all property lines and at the nearest neighbor are below the chronic ammonia iHRV of 80 µg/m³.

The CALPUFF-generated property-line and nearest-neighbor tVOOC concentrations before and after construction of the north finishing barn are provided in Table 4-65. Without the north finishing barn, the maximum property-line tVOOC concentration is 41.22 µg/m³. With the north finishing barn, the maximum property-line tVOOC concentration is 48.78 µg/m³, which is considered to represent a detectable swine odor that is below the annoyance threshold of 70 µg/m³. As illustrated in Figure 4-56, the maximum nearest-neighbor tVOOC concentration of 13.32 µg/m³ is 5 times less than the annoying odor threshold concentration.

The CALPUFF-generated off-site concentrations of hydrogen sulfide, ammonia, and tVOOC representing the local air quality before construction of the north finishing barn are provided in Figures 4-57, 4-58, and 4-59, respectively. The off-site graph for tVOOC suggests the potential for detectable (non-annoying) swine odors to persist for up to 1600 feet beyond site’s south property line.
The \textit{CALPUFF}-generated off-site concentrations of hydrogen sulfide, ammonia, and tVOOC representing the local air quality after construction of the north finishing barn are provided in Figures 4-60, 4-61, and 4-62, respectively. The off-site graph for tVOOC suggests the potential for detectable (non-annoying) swine odors to persist for up to 2000 feet beyond site’s south property line.

4.1.2.9 Spohr Site

As shown in Figure 4-63, the Spohr site currently consists of three hog barns. The north barn is a 70-foot by 60-foot straw-pack barn. The east barn is a mechanically ventilated finishing barn with a shallow manure pit. The south barn is a 208-foot by 41-foot curtain-sided barn with a deep manure pit. This deep pit also receives manure from the east barn. Only the south barn is associated with the formation of HPP. Prior to the construction of the south barn, manure from the east barn drained into an 85-foot by 85-foot manure basin, which was located near the east end of the present south barn. The current property-line setbacks range from 155 feet to over 3672 feet. The site’s nearest neighbor is located about 1800 feet southwest of the south barn. The dimensions and capacities of the three existing hog barns are provided in Table 4-66.

When the emission rates for the south barn were measured in April 2001, no pigs were present in the north and east barns and emission rates were not measured for these two barns. The emission rates for the north barn were calculated based on the average emission fluxes observed for the Olson and Zeltwanger straw-pack barns. The emission rates for the east barn were calculated based on the emission flux rates observed for the south finishing barn at the Solvie site. The measured and calculated emission rates for the three Spohr barns are provided in Table 4-67. In calculating the hourly emission flux values for the non-existent manure basin, the chemical characteristics of the Solvie basin were assumed to be applicable. The resulting hourly temperature and emission flux rates are similar to those illustrated in Figures 4-52 through 4-55 for the Solvie basin.

The \textit{CALPUFF}-generated property-line hydrogen sulfide concentrations for the Spohr site before and after the replacement of the manure basin with the south barn are provided in Table 4-68. Prior to the replacement of the manure basin with the south barn, the highest \textit{CALPUFF}-generated concentration with a background of 17 ppb is 37.34 ppb, which is above the ambient standard of 30 ppb. After replacement of the manure basin with the south barn, the highest \textit{CALPUFF}-generated concentration with a background of 17 ppb is 23.19 ppb, which is below the ambient standard of 30 ppb. As illustrated in Table 4-69, the \textit{CALPUFF}-generated maximum 13-week property-line concentration is below the sub-chronic hydrogen sulfide iHRV of 7.1 ppb. The HPP associated expansion of the Spohr site by 300 AU resulted in decreased property-line and nearest-neighbor hydrogen sulfide concentrations, because a deep-pitted barn replaced a manure basin.
**CALPUFF** and the *PitEmissions* software were used to estimate the relationship between the maximum hourly hydrogen sulfide property-line concentration and the uniform total dissolved sulfide concentration in the manure pits located beneath the east and south barns. In this analysis, the hydrogen sulfide emissions from the north barn were assumed to have an insignificant effect on west property-line hydrogen sulfide concentrations. The two manure pits were assumed to have a manure temperature of 10.5°C and a manure pH of 7.22. As illustrated in Figure 4-64, the total dissolved sulfide concentration in both manure pits must be below 9.2 mg S/L for the maximum hourly west property-line hydrogen sulfide concentration to be below 13 ppb (30 ppb with a 17-ppb background).

The maximum hourly time-averaged property-line and nearest-neighbor ammonia concentrations that were estimated by the **CALPUFF** model for before and after replacement of the manure basin with the south barn are provided in Table 4-70. Before replacement, the highest estimated property-line concentration with a background concentration of 148 µg/m³ is 1144 µg/m³, which is below the acute ammonia iHRV of 3200 µg/m³. After replacement, the highest estimated property-line concentration with a background concentration of 148 µg/m³ is 1555 µg/m³, which is also below the acute iHRV for ammonia. Thus, the modeling results suggest that the Spohr site continues to have property-line ammonia concentrations below the acute ammonia iHRV. As provided in Table 4-71, the **CALPUFF**-generated annual-average ammonia concentrations along all property lines and at the nearest neighbor are below the chronic ammonia iHRV of 80 µg/m³.

The **CALPUFF**-generated property-line and nearest-neighbor tVOOC concentrations before and after the replacement of the manure basin with the south barn are provided in Table 4-72. With the manure basin, the maximum property-line tVOOC concentration is 60.96 µg/m³. With the deep-pitted south barn, the maximum property-line tVOOC concentration is 35.88 µg/m³, which represents a detectable swine odor that is below the annoyance threshold of 70 µg/m³. The replacement of the manure basin with the south barn resulted in lower tVOOC concentrations. As illustrated in Figure 4-65, the maximum nearest-neighbor tVOOC concentration after the construction of the south barn of 7.54 µg/m³ is 9 times less than the odor annoyance threshold concentration.

The **CALPUFF**-generated off-site concentrations of hydrogen sulfide, ammonia, and tVOOC representing the local air quality before replacement of the manure basin with the south barn are provided in Figures 4-66, 4-67, and 4-68, respectively. The off-site graph for tVOOC suggests the potential for detectable (non-annoying) swine odors to persist for up to 1300 feet beyond the site’s west property line.

The **CALPUFF**-generated off-site concentrations of hydrogen sulfide, ammonia, and tVOOC representing the local air quality after replacement of the manure basin with the south barn are provided in Figures 4-69, 4-70, and 4-71, respectively. The off-site graph for tVOOC suggests...
the potential for detectable (non-annoying) swine odors to persist for up to 1300 feet beyond Spohr’s west property line.

4.1.2.10 Zeltwanger Site

The Zeltwanger site consists of three straw-pack hog-finishing barns on about 300 acres of land. As illustrated in Figure 4-72, the property line setback distances for the site range from 184 to 3369 feet. The site’s nearest neighbor is located about 1300 feet west-southwest of the hog barns. The dimensions and capacities of the three straw-pack finishing barns are provided in Table 4-73. The hydrogen sulfide, ammonia, and tVOOC emission rates were measured for the west barn. The emission rates for the east and south barns were calculated based on their floor surface areas relative to the west barn. The various emission rates for the three barns are provided in Table 4-74.

The CALPUFF modeling results suggest that the Zeltwanger hog-finishing site complies with the Minnesota ambient air quality standard for hydrogen sulfide. The estimated maximum hourly property-line and nearest-neighbor concentrations for the Zeltwanger site are provided in Table 4-75. When a background concentration of 17 ppb (v/v) is added to the CALPUFF-generated concentration, the maximum estimated property-line hydrogen sulfide concentration is 20.41 ppb (v/v), which is below the ambient standard of 30 ppb. As illustrated in Table 4-76, the CALPUFF-generated maximum 13-week property-line and nearest-neighbor concentrations are below the sub-chronic hydrogen sulfide iHRV of 7.1 ppb.

The maximum hourly time-averaged property-line and nearest-neighbor ammonia concentrations that were estimated by the CALPUFF model are provided in Table 4-77. The highest estimated property-line concentration with a background concentration of 148 µg/m³ is 988 µg/m³, which is below the acute ammonia iHRV of 3200 µg/m³. Thus, the modeling results suggest that the Zeltwanger site does not exceed the acute ammonia iHRV. As illustrated in Table 4-78, the modeled annual property-line and nearest-neighbor ammonia concentrations are below the chronic ammonia iHRV of 80 µg/m³.

The CALPUFF-generated maximum hourly tVOOC concentrations for the Zeltwanger site’s property lines and nearest neighbor are provided in Table 4-79. The maximum property-line concentration is 6.8 µg/m³ at the south property line, which is less than the 10 µg/m³ threshold for detectable (non-annoying) swine odors. As illustrated in Figure 4-73, the maximum nearest-neighbor tVOOC concentration of 1.72 µg/m³ is 40 times less than the annoying odor threshold concentration of 70 µg/m³.

The CALPUFF-generated off-site concentrations of hydrogen sulfide, ammonia, and tVOOC for the Zeltwanger site are provided in Figures 4-74, 4-75, and 4-76, respectively. The graphs
suggest that no significant off-site plumes relative to the threshold concentrations listed in Table 4-1 exist for the Zeltwanger site.

### 4.1.2.11 Summary of Site Specific Air Effects

The *CALPUFF* air quality model estimated the property-line and off-site concentrations of hydrogen sulfide, ammonia, and tVOOC for the 10 Hancock Pro-Pork sites. The *CALPUFF*-generated concentrations were compared to the concentration thresholds for potential environmental effects listed in Table 4-1. Except for the farrowing site, all sites complied with the 50-ppb ambient air quality standard for hydrogen sulfide. All sites had 13-week time-averaged property-line hydrogen sulfide concentrations that did not exceed the sub-chronic hydrogen sulfide iHRV of 10 µg/m³. All sites had hourly property-line ammonia concentrations that did not exceed the acute ammonia iHRV of 3200 µg/m³. All sites had annual property-line ammonia concentrations that did not exceed the chronic ammonia iHRV of 80 µg/m³.

The modeled ability of the sites to not exceed the various hourly threshold concentrations for hydrogen sulfide and tVOOC varies from site to site. As indicated in Table 4-80, the farrowing, Nohl, Schaefer (existing), Schaefer (third barn), and Solvie sites have the modeled potential to exceed 30 ppb hydrogen sulfide standard at their property lines. However, time series analysis indicated that only the farrowing, Schaefer (existing), and Schaefer (proposed) sites have the potential to violate the 30 ppb hydrogen sulfide standard. The modeling results also suggest the potential for the farrowing, Schaefer (existing), and Schaefer (proposed) sites to generate off-site episodes of annoying odors based on the hourly tVOOC concentrations at the property lines.

### 4.1.3 Regional Air Quality Effects

Regional air quality modeling was performed to assess the potential for emissions from the HPP sites to combine with emissions from neighboring sources to cause significant cumulative impacts on regional air quality. In a previous study of cumulative effects for the region, modeled hourly concentrations of hydrogen sulfide exceeded 30 ppb for distances up to 7.8 kilometers downwind of feedlots (MPCA 1998). The modeled long plumes of elevated hydrogen sulfide and ammonia concentrations suggested the strong potential for adverse cumulative effects. However, such long plumes are considered to be an artifact of the steady-state Gaussian plume model used in the study.

The modeled regional sources were the 10 HPP sites, 13 non-HPP sites that consisted of hog barns, and 15 non-HPP sites having outdoor storage basins holding either swine or dairy manure. Emissions from the modeled non-HPP hog barns were assumed to have emission flux rates equal to the average of the 7 sampled HPP deep-pitted barns. The modeled swine manure basins were assumed to have the same chemical characteristics as the sampled Solvie manure basin. The
modeled dairy basins were assumed to have a pH of 7.8, a dissolved volatile organic acid concentration of 1860 mg/L, a total dissolved phenol concentration of 5.1 mg/L, a total dissolved sulfide concentration of 0.7 mg S/L, and a dissolved ammonia-nitrogen concentration of 815 mg N/L. All swine and dairy manure basins were assumed to be crust-free. The locations and dimensions of the non-HPP sources were obtained from the previous regional study MPCA 1998). The locations of the 38 modeled feedlot sources are plotted in Figure 4-77.

A set of 5,625 receptors was used to characterize the regional gas concentrations. The receptors were arranged in a 75 by 75 receptor grid with a spacing of 500 meters. The southwest corner of the receptor grid had an x-coordinate of 10 km east and a y-coordinate of 9 km north. The coordinates of the grid’s northeast corner were 47 km east and 46 km north.

The pre-Hancock regional hydrogen sulfide, ammonia, and tVOOC concentrations are provided in Figures 4-78, 4-79, and 4-80, respectively. The CALPUFF results indicate that the highest concentrations tend to be centered on the individual feedlot sources. There are no plumes of elevated gas concentrations that extend for kilometers downwind of sources. In general, the CALPUFF results suggest that air quality effects associated with feedlot emissions are localized within a half-mile of a feedlot. However, the one noticeable exception is the cluster of 3 non-HPP feedlots located about 6 miles east-southeast of Morris. The close proximity of the 3 feedlots results in a common area of elevated gas concentrations. Except for this 3-feedlot cluster, the pre-HPP regional modeling results suggest that cumulative effects play a small role in defining air quality impacts. To the extent that the feedlots in question inject their manure, as many do, the adverse effects are even further reduced.

The post-HPP regional hydrogen sulfide, ammonia, and tVOOC concentrations are provided in Figures 4-81, 4-82, and 4-83. In general, the construction or expansion at the HPP sites results in the formation of additional isolated areas of elevated gas concentrations. The HPP sites are located sufficiently far from one another and from the modeled non-HPP sites so that no cumulative effects are observed. The one exception appears to be the Nohl site (4 miles southeast of the Town of Hancock), which shares a 3-ppb hydrogen sulfide isopleth and a 10-µg/m3 tVOOC isopleth with a neighboring feedlot located to Nohl’s south-southeast. The two sites do not share the plotted 500-µg/m3 ammonia isopleth.

In summary, the regional CALPUFF results suggest that the HPP sites are located sufficiently far from one another and from the modeled non-HPP sites so that cumulative impacts appear to be insignificant with regard to standards violations.
4.2 GROUND WATER

4.2.1 Site Specific Effects

4.2.1.1 Farrowing Facility

As discussed in Section 3.8.1, the surficial aquifer exists beneath nearly all land available for land application of manure associated with the farrowing facility and ground water is approximately 10 feet bgs. Approximately 80 percent of the soils identified in the land application sites and feedlot are granular. Soil slopes are nearly level to gently sloping. Manure application rates on land application fields follow the recommended agronomic rates calculated based on manure and soil nutrient content and expected crop yields. However, the combination of granular soils and the close proximity of the ground water to the surface elevates the potential for contamination of local ground water. Restricting manure application on granular soils to the spring would reduce the risk of ground water contamination. In addition, ground water in the area appears to be “nitrate unstable,” thus providing some natural protection to mitigate nitrate impacts.

Fifty-five wells were identified within one-half mile of the land application areas associated with the farrowing facility. Uses of the wells include twenty-eight for irrigation purposes and twenty-seven for domestic water supply. Ten of the wells are completed in the surficial aquifer and 17 wells are completed in buried glacial drift aquifers. The majority of the wells without an aquifer designation are shallow and likely utilize the surficial aquifer.

The MPCA completed a preliminary ground water investigation at the farrowing site in 2000, which included installation of 9 temporary wells and the collection of ground water samples. The ground water samples were primarily collected from the water table, which would represent the location of anticipated maximum impact. The data showed nitrate levels above the HRL in some shallow samples. As expected, the water table had relatively high dissolved oxygen and was a non-reducing (“nitrate stable”) environment. Therefore, nitrate would persist there. However, when a sample was obtained from deeper within the surficial aquifer, nitrate was not detected, dissolved oxygen was low and the environment was more reducing. This suggests denitrification is occurring with depth within the surficial aquifer. See Section 3.3.2 for a more in-depth discussion.

Manure storage at the farrowing facility is provided by five concrete pits, with a combined capacity of 4.2 million gallons. The pits built at the farrowing facility are poured concrete, one of the better options for minimizing leakage to ground water (Mulla et al 2001). Risks to ground water posed by leaks from the concrete storage pits appear minimal based on the MPCA ground water quality investigation in 2000.
If a manure spill or an overflow of manure from the pits were to occur, it may impact the surficial ground water quality. The facility has not reported a manure spill or pit overflow during its operational history.

4.2.1.2 Charles

As discussed in Section 3.8.2, the surficial aquifer does not appear to exist beneath any land available for land application of manure associated with the Charles facility. The Stevens County soil atlas indicates all soils present in the potential manure land application areas consist of silt or clay loams. Soil slopes are nearly level to gently sloping. The risk of impacting ground water is minimal from manure land application on the Charles fields.

Eleven wells were identified within one-half mile of potential manure land application areas associated with the Charles facility. The wells include eight for domestic water supply, one of unknown use, and two City of Hancock municipal supply wells. Ten of the eleven wells are noted as being finished in a buried aquifer (one finished at unknown aquifer and depth). The municipal wells are located within the city of Hancock and not within or near any spreading fields. Since the surficial aquifer is not present in the area, the unknown well is likely a buried aquifer well. Risks of impact to all the identified domestic water supply wells appear minimal as cohesive soils are present, and all identified domestic water supply wells utilize buried aquifers.

Manure storage at the Charles facility would be provided by one 435,000-gallon underbarn concrete storage pit. Risks to ground water posed by leaks from the concrete storage pit appear minimal based on the cohesive nature of the soil in the area and the nature of poured concrete pits.

If a manure spill or an overflow of manure from the pits were to occur, it would be unlikely to impact ground water quality due to the cohesive soils and depth to ground water in the area.

4.2.1.3 Greiner

The surficial aquifer does not appear to exist beneath any land available for land application of manure associated with the Greiner facility. The Pope County soil atlas indicates all soils present in the manure land application areas consist of silt or clay loams. Soil slopes are described as level to undulating and rolling. The risk of impacting ground water is minimal from manure land application to the Greiner fields.

Two (2) wells were identified within one-half mile of manure land application areas associated with the Greiner Facility. Both wells are for domestic water supply and completed in buried aquifers. Although regional ground water flow is primarily to the south, local ground water flow
may be affected by the proximity of Lake Emily, north of the Greiner Facility. Risks of impact to the two identified domestic water supply wells appear minimal as they utilize buried aquifers.

Manure storage at the Greiner Facility is provided by one 435,000-gallon concrete storage pit. Risks to ground water posed by leaks from the concrete storage pit appear minimal based on the cohesive nature of soil in the area and the nature of poured concrete pits.

If a manure spill or an overflow of manure from the pits were to occur, it would be unlikely to impact ground water quality due to the cohesive soils and depth to ground water in the area. The facility has not reported a manure spill or pit overflow during its operation history.

4.2.1.4 Nohl

The surficial aquifer exists beneath all land available for land application of manure associated with the Nohl facility. This aquifer lies approximately 10 feet bgs and generally flows southeast with a saturated thickness of approximately 20 to 40 feet. The Stevens County soil atlas indicates that the soils present in the potential manure land application areas are generally granular sandy loams. Surface slopes are nearly level to gently sloping. The combination of granular soils and the close proximity of the ground water to the surface elevates the potential for contamination of surficial ground water.

Fourteen (14) wells were identified within one-half mile of potential manure-land application areas associated with the Nohl Facility. The wells include three (3) domestic water supply wells and eleven (11) irrigation wells. Ten of the irrigation wells utilize the surficial aquifer. All three of the domestic wells utilize the buried aquifers. Risks of impact to the irrigation wells that utilize the surficial aquifer may be elevated due to the presence of a shallow water table and granular soils. Risks of impact to the domestic water supply wells appear minimal as they utilize a buried glacial drift aquifer.

Manure storage at the Nohl facility is provided by two concrete storage pits with a combined capacity of 853,000 gallons. Risks to ground water posed by leaks from the concrete storage pits appear minimal.

4.2.1.5 Olson

The surficial aquifer appears to exist beneath all land available for land application of manure associated with the Olson facility. This aquifer lies approximately 10 feet bgs and generally flows south or southeast with a saturated thickness of approximately 20 feet. The Stevens County soil atlas indicates that soils present in the manure land application areas consist of both cohesive and granular soils. Cohesive silt and clay loams occupy manure land application areas in T123N R41W Section 27 and the eastern portion of the Olson facility in T123N R41W
Granular soils occupy the central portion of the Olson facility. Slopes are nearly level to gently sloping. The combination of granular soils and the close proximity of the ground water to the surface elevates the potential for contamination of surficial ground water. However, risks to ground water appear minimal due to the relatively low volume of solid manure that is produced at this facility. Manure applied on Olson’s land by the farrowing facility must be applied in the spring if the fields used for this purpose are composed of granular soils, or, alternatively, the farrowing facility’s MMP must be updated to show how fall application would not harm groundwater.

Eighteen (18) wells were identified within one-half mile of manure land application areas associated with the Olson Facility. One (1) is a domestic water supply well, ten (10) are irrigation wells and seven (7) are test wells. The single domestic well is a shallow well that utilizes the surficial aquifer. Risks of impact to the wells, including the domestic supply well, that utilize the surficial aquifer may be elevated due to the presence of a shallow water table and granular soils.

Ten temporary monitoring wells were installed and sampled at the Olson site by the MPCA. Two of the samples detected nitrate above 10 mg/l. Both samples were collected from the water table and located directly down gradient from the facility’s open lot. A sample collected from a deeper portion of the surficial aquifer did not detect nitrate. This suggests denitrification is occurring with depth within the surficial aquifer.

4.2.1.6 Paul

The surficial aquifer does not appear to exist beneath any land available for land application of manure associated with the Paul facility. The Stevens County soil atlas indicates all soils present in the manure land application areas consist of silt or clay loams except for a small area in the northeast quarter of T123N R42W, Section 15. Soils in this area consist of gravelly sandy loam. Slopes are nearly level to gently sloping. Records indicate that the facility does not over apply manure to available fields. The risk of impacting ground water is, therefore, minimal from manure land application to the Paul fields.

Twelve (12) wells were identified within one-half mile of manure land application areas associated with the Paul facility. Uses of the wells include six (6) for domestic water supply and four (6) for irrigation. Since all of the identified domestic water supply wells are completed in buried aquifers, the surficial aquifer does not appear to exist beneath any of the manure land application areas associated with the Paul facility, and cohesive soils are present in nearly all areas, risks to users of ground water appear minimal.
Manure storage at the Paul facility is provided by one 435,000-gallon concrete storage pit. Risks to ground water posed by leaks from the pit appear minimal due to the cohesive soils present at the site and storage in an engineered concrete pit.

4.2.1.7 Schaefer

The surficial aquifer exists beneath certain manure land application areas available to the Schaefer facility in T123N R41W Section 22. The aquifer lies approximately 20 feet bgs and generally flows southeast with a saturated thickness of zero to 20 feet. The Stevens County soil atlas indicates nearly all soils present in the manure land application areas consist of silt or clay loams. Slopes are nearly level to gently sloping. Available records indicate that the facility does not over apply manure to available fields. Therefore, the risk of impacting ground water is minimal from manure land application to the Schaefer fields.

Sixteen wells were identified within one-half mile of manure land application areas associated with the Schaefer Facility. Uses of the wells include five for domestic water supply, six for irrigation, three designated as test wells, and two of unknown use. All of the domestic water supply wells are completed within buried aquifers. Risks of impact to the identified domestic water supply wells therefore appear minimal.

Two temporary monitoring wells were installed and sampled at the Schaefer site by the MPCA. Some samples indicated nitrate levels above the HRL. However, the data are inconclusive regarding the potential for impact. Collection of samples was difficult owing to the cohesive nature of the area’s soil and the resulting very slow water level recovery rate in the borehole. See Section 3.3.2 for a more in-depth discussion.

Manure storage at the Schaefer facility is provided by one proposed and two existing deep concrete storage pits with a combined storage capacity of 1.3 million gallons. In the older straw pack barn, a relatively small amount of manure is directly scraped and hauled for land application. Risks to ground water posed by leaks from the concrete storage pit and potential spills appear minimal based on the cohesive nature of the soil at the site and the MPCA study referenced above. Risks to ground water posed by the area in which manure is scraped and hauled appear minimal due to the low volume of manure treated in this manner.

4.2.1.8 Solvie

The surficial aquifer exists beneath some portions of fields available for land application of manure from the Solvie facility. In areas in which the surficial aquifer is present, the water table lies approximately 30 feet bgs and generally flows southeast toward the Chippewa River. The saturated thickness of the surficial aquifer is zero to 40 feet. The Pope County soil atlas indicates soils present in the manure land application areas consist of both cohesive and granular soils.
Soils in the central portion of the facility in T124N R40W Sections 4 and 5 consist of silt and clay loams. Soils at the western and eastern margins of the Solvie facility are primarily sandy soils. Soil surfaces are level to sloping. Available records indicate that the facility does not over apply manure to available fields. The risk of impacting ground water is therefore considered to be minimal from manure land application to the Solvie fields.

Twenty five (25) wells were identified within one-half mile of manure land application areas associated with the Solvie Facility. The wells include eleven (11) domestic water supply wells, thirteen (13) irrigation wells, and one (1) of unknown use. All of the domestic wells are completed in buried aquifers. Risks of impact to all identified domestic water supply wells therefore appear minimal. Risks of impact to irrigation wells that utilize the surficial aquifer may be elevated due to the presence of the water table at approximately 30 feet bgs and granular soils.

Risks to ground water posed by leaks from the earthen basin may be slightly elevated as the permeability of earthen basins is generally greater than concrete pits. Conclusions drawn by Mulla et al (1999) in the Literature Summary for Water Quality for the GEIS indicate the following:

"Under certain circumstances, seepage from manure holding basins and lagoons can have a very serious impact on ground water quality, especially from nitrate-N and ammonium-N. These impacts are greatest with unlined earthen manure storage systems, and lined pits constructed in granular soils. Seepage losses generally occur when the sidewalls become cracked or develop macropores. Lined basins and lagoons which are properly constructed, engineered, and managed are generally not a serious threat to ground water quality, unless constructed in granular soils or karst terrain."

Manure storage at the Solvie facility is provided by one concrete pit and a clay-lined basin with a combined storage capacity of 1.45 million gallons. Both manure storage structures are constructed in cohesive soils. The designs of the clay-lined basin and concrete pit were listed as compliant structures in the Certificate of Compliance issued to Solvie. Potential impact to ground water is minimal due to the cohesive soils present on the feedlot.

4.2.1.9 Spohr

The surficial aquifer does not appear to exist beneath any land available for land application of manure from the Spohr facility. The Stevens County soil atlas indicates that all soils present in the manure land application areas consist of silt or clay loams. Slopes are nearly level to gently sloping. Land application practices at the site do not indicate over-application of manure. The risk of impacting ground water is minimal from manure land application to the Spohr fields.
Three wells were identified within one-half mile of manure land application areas associated with the Spohr facility. Uses of the wells include two for domestic water supply and one irrigation well. The identified domestic water supply wells are completed in a buried aquifer. As the surficial aquifer does not appear to exist beneath any of the manure land application area associated with the Spohr Facility, cohesive soils are present, and the single identified domestic water supply well utilizes a buried aquifer, risks to users of ground water appear minimal.

Manure storage at the Spohr facility was previously provided by one 266,175-gallon earthen basin. During construction of the new HPP barn, the clay material of which the earthen basin was constructed was excavated and land applied to an adjacent field. The barn constructed within the excavated pit includes a 435,000-gallon concrete pit, which currently provides the bulk of the manure storage at the Spohr facility. A small amount of manure (a little over 42,000 gallons) is stored in the shallow underbarn pit of the pre-project pit barn and another small amount of manure is directly scraped and hauled for land application. Risks to ground water posed by leaks from the concrete storage pits appear minimal based on the cohesive nature of native soils and the nature of poured concrete pits. Risks to ground water posed by the area in which manure is scraped and hauled also appear minimal due to the low volume of manure handled in this manner.

4.2.1.10 Zeltwanger

The surficial aquifer does not appear to exist beneath any land available for land application of manure associated with the Zeltwanger facility. The Stevens County soil atlas indicates all soils present in the potential manure land application areas consist of silt or clay loams. Soil slopes are nearly level to gently sloping. Estimated land application practices at the site do not indicate over-application of manure. The risk of impacting ground water is, therefore, considered to be minimal from manure land application to the Zeltwanger fields.

Thirty-six wells were identified within one-half mile of potential manure land application areas associated with the Zeltwanger Facility. The wells include fifteen domestic water supply wells, seven irrigation wells, three designated as test wells, six of unknown use, and five public supply wells. The public supply wells are deep wells completed in buried aquifers. None of the other wells are listed as being finished in surficial water table aquifers. Risks of impact to the identified wells appear minimal as the wells are completed in buried aquifers, the surficial aquifer does not appear to exist beneath any land available for land application, and soils are cohesive.

There is little to no manure storage at the facility. If winter conditions require, Zeltwanger has an old feed bunker to temporarily stockpile manure. Risks to ground water appear to be minimal due to the low volume of manure that is managed at this facility.
4.2.2 Cumulative Effects

The cumulative effects from the HPP project appear to be minimal. Risks to wells completed within buried aquifers appear to be minimal due to the presence of the relatively low permeability glacial till separating the aquifers from the surface.

There is a potential impact to the wells located near the Olson feedlot due to the shallow potentiometric water surface in the area and the presence of granular soils. However, the wells are used for irrigation and not for human consumption. The Hancock municipal wells are not located in or near spreading fields, and thus impacts on them from the project are unlikely.

Ammonia and organic forms of nitrogen (the typical forms present in animal wastes) are typically immobilized in the unsaturated zone and are not likely to reach ground water in appreciable quantities. From a nitrate management perspective, the general trend of the regional ground water, based on site-specific geochemistry, suggests a reducing environment in which nitrate is rapidly converted to reduced forms. This coupled with the findings of MPCA studies of ground water quality adjacent to animal feedlots suggests that nitrate will not be persistent in the area of the project. This is also consistent with the absence of elevated nitrate concentrations reported in ground water samples from elsewhere in the region. Utilization of best management practices in applying manure, in concert with the nitrate reducing ground water environment, should result in minimal nitrate impacts to the ground water.

Ground water can also be affected by pathogens in which soils are permeable or prone to macropore or preferential pathway development. The potential for contamination of ground water by pathogens is typically less than that for contamination of surface water, due to the soil's filtering ability and the antagonistic competition of other organisms and environmental forces in the soil. As long as preferential pathways, or 'short-circuits' (eg, unsealed or improperly sealed wells) are kept to a minimum, pathogen migration to ground water from the feedlots and associated land application sites should be minimal.

4.3 Surface Water Quality

The following sections discuss the current or potential effects that feedlot operations may have on the surface water quality in the immediate vicinity of each site.

Several studies discussed by Earth Tech (2001) in the GEIS Technical Working Paper for Air Quality and Odor Impacts indicate that atmospheric transport and deposition of nitrogen may represent an additional source of nutrients to the environment. As discussed in Section 3.7.3, reactions of ammonia emissions within the atmosphere allow formation of ammonium particulates that are deposited on the earth as a result of emissions from nearby concentrated feedlots. Two studies (conducted at a dairy feedlot in 1975 and another in Canada published in
2000) indicated that locations between 500 meters and 1 km down gradient from the emission source exhibited elevated ammonia deposition rates above background levels. These depositions could damage freshwater systems in the immediate vicinity of the feedlot and cause eutrophication of water bodies. Earth Tech (2001) indicates that studies of this phenomenon are limited and additional information is needed on specific impacts to the environment.

The DNR-Glenwood office expressed concern in regard to the effects from manure land application and subsequent addition of phosphorus and other nutrients and sediment to surface waters, especially in areas where the land application is immediately adjacent to surface waters (Lake Emily and the Chippewa River in particular). The water quality in surface waters in the project area is currently hypereutrophic.

4.3.1 Site Specific Effects

4.3.1.1 Farrowing Facility

There are 6 drain tile inlets (TI) on the farrowing facility site. Two TIs are located on the west side of the farrowing barn, two on the outer perimeter of the gestation barns, and two between the three gestation barns. For locations of site tile inlets refer to Figure 3-9.

Perimeter tile drains surrounding the concrete storage pits were installed to keep ground water below the pit floor to minimize ground water pressure on the pit walls. Sumps were also installed to collect the water from the perimeter tile drains. These sumps have been dry since construction of the facility. Protocols to sample and monitor the sumps are in place and will be implemented if the sumps begin to flow.

Impacts from contaminated storm water are expected to be minimal at the farrowing facility. Storm water contact with manure pits and animals is minimized because animals and manure are totally confined in the barns. Grading at the site directs storm water away from the concrete manure pits towards the catch basins or other vegetated areas. The facility has a designed storm water system that reduced erosion and increases the filtration of sediments and nutrients before water leaves the site. Storm water runoff from the west side of the nursery barn is directed towards a vegetated area to the west that flows northward and around the north side of the facility. Storm water flow on the east side of the farrowing barns, between the B-G barns, and water from the perimeter sumps, flows into catch basins between the B-G barns. The catch basins discharge east under the road through relatively small pipes designed to restrict flow from the catch basins, improving the filtering properties of the system in that area. All surface water at the facility eventually flows to a vegetated shallow depression area (sediment retention area). When water in the sediment retention area reached a depth of approximately six inches, water flows into a tile inlet on the north end of this area. After a storm event, water remaining in the retention basin eventually soaks into the soil. Vegetation along the drainage route and within the
sediment retention area acts a filter by removing sediments and nutrients from the water, thereby minimizing the risk of contamination. The water that reaches the field tile line drains to a ditch approximately 1/2 mile away. The ditch drains into Judicial JD 9, which in turn leads to CD 83 and ultimately to the Chippewa River.

An unnamed stream connecting to JD 9 cuts across the northern portion of Moore Township Section 34. A wetland is located approximately 800 feet south of the land application area in Section 9 of Tara Township in Swift County. This wetland is not on the land leased by HPP. The distance from the application site makes impacts from manure application unlikely. Impacts from manure application should be minimal as long as manure is applied at agronomic rates and required setbacks are followed.

A Manure Management Plan (MMP) for the farrowing facility was submitted to the MPCA with the 1997 construction application documents, complete with fields documented that are to be used for manure land application. The MMP for the farrowing facility was updated in June 2002 and is included in Appendix B. This plan indicates land application of liquid manure is performed by knife injection or chisel plow. The facility does not apply on granular soils in the fall. No land application is performed during the winter season.

The storage capacity for the site exceeds the predicted annual manure generation and the average total annual volume of manure applied during operation at the farrowing facility. This will minimize the potential for overflow and a manure spill.

Animal mortalities are either picked up by a renderer or incinerated in the on-site incinerator. The farrowing facility stores its mortalities for rendering in a freezer trailer near the farrowing facility.

4.3.1.2 Charles

There are five TIs on land near the proposed site of the Charles feedlot and an additional 24 TIs are located throughout the land application areas. See Figure 3-10 for approximate locations. The TIs drain into private ditches that eventually flow into JD 9. A surface water body lies within 1/2-mile of the Charles land application areas. Prescribed setbacks would be observed for fields near this wetland.

Impacts from contaminated storm water are expected to be minimal at the Charles facility. Hogs and manure would be inside the barn at all times, minimizing contact with storm water. The storm water from the site is conducted via overland flow to adjacent fields, and remaining on Charles property.
One concrete manure storage pit has been proposed for construction. This pit would be large enough to store the anticipated annual manure production at the facility. Charles intends to use Liqui-Blue® pit additive and possibly Barrier® pit additive to breakdown solids and control odor emitted from the pit. If this facility is built and Gibson Waste Removal is employed to apply manure, the pit additive, Liqui-Blue® would be added to the concrete pits at a rate of 5 gallons per year.

The active ingredient in Liqui-Blue® is copper sulfate. Copper sulfate is used in algaecides to control algal blooms within lakes and ponds. It is extremely toxic to fish in sufficient concentration, and long-term use of this compound may actually increase the incidence of algal blooms. When copper sulfate is added to hard water, it reacts to form an insoluble salt, copper carbonate. Copper carbonate buildup on the bottom of the lake or pond will inhibit the growth of rooted bottom vegetation over a period of time. Nutrients that the bottom vegetation would have consumed are available for algae to use and contribute to excessive algal growth (Aquatic Systems Inc. 2002). The amount of copper sulfate annually applied to 100 acres at the above rate of Liqui-blue addition would come to about 5g/acre. This small amount of copper sulfate applied to cropland is not likely to impact local surface waters.

The manufacturer claims that Barrier® is environmentally friendly, but provides no data to support this. The Material Safety Data Sheet (MSDS) for the product does not indicate that environmental or animal testing has been performed (Agrilance LLC 2000). MSDSs for component chemicals 1-4 dioxane and ethylene oxide indicate that they could be carcinogenic to humans at acute exposure at high concentration and for long-term exposure at low concentration. The component chemical 1,4-dioxane evaporates from dry soil when exposed to air. Once in the air it is reported to break down into other chemicals (USEPA 1995). It appears that 1,4-dioxane has low toxicity to aquatic life and is not likely to cause environmental harm at levels normally found in the U.S environment according to USEPA (1995).

Land application would reportedly occur via injection or broadcasting with immediate incorporation. No land application has historically occurred on any fields that are associated with the Charles finishing site. The land application fields do not contain granular soils. Discussions with Charles have indicated that he is aware of the manure land application setback requirements near tile inlets and drainage ditches and that he would follow them. He also would test the soil and manure to determine the appropriate manure application rates for the fields.

Dead animals would be composted on a covered concrete pad on other property owned by the family (personal communication with Charles, April 2002). Charles would use manure and straw as the bulking material for the compost operation. Once compost is finished it would be applied and incorporated into nearby cropland. Composting procedures described by Charles generally follow the Minnesota Board of Animal Health (BAH) guidelines and regulations.
Impacts to surface waters for this site should be minimized as long as planned practices are implemented.

4.3.1.3 Greiner

The Greiner feedlot has fourteen TIs located on the land application fields, and none on the site proper. The TIs drain to the adjacent road ditches and eventually to the wetlands immediately adjacent to the land application areas. The barn is built on a hill and runoff is directed away from the barn. See Figure 3-11 for locations of TIs near the facility.

Impacts from contaminated storm water are minimal at the Greiner facility. Hogs and manure remain inside the barn at all times, minimizing contact with storm water. Storm water from the site is conducted via overland flow to adjacent fields north of the barn and remains on Greiner property.

Perimeter tile drains surround the concrete pits. A sump collects the water from the perimeter tile lines and discharges it to a nearby road ditch adjacent to the facility. The road ditch eventually drains to an open field on a neighbor's property (Greiner, personal communication, June 2002). Two surface waters (Lake Emily and a federal wildlife protection area) lie within 1/2-mile of the site. The Greiners report following prescribed land application setbacks from surface waters and tile inlets.

The storage capacity exceeds the annual manure production at the facility. The land application areas appear to be sufficient to apply all the manure generated yearly.

The Greiners use a licensed manure application service, Gibson Waste Removal. Gibson Waste Removal adds the pit additive Liqui-blue™ to the concrete pits it pumps at a rate of 5 gallons per year. Potential impacts from this additive were discussed in Section 4.3.1.2 and are not likely to impact surface waters. Manure is land applied via injection. Gibson Waste Removal uses the data from manure and soil tests to determine the land application rates. Land application areas are shown on Figure 2-11. Granular soils were not identified within the land application areas. Winter land application does not occur at this facility.

Greiner currently reports that he has a renderer pick up the animal mortalities at the site.

4.3.1.4 Nohl

There is one surface TI located on the east side of the passageway that connects the two barns. Floe from this TI flows west through a wooded area and eventually reaches a private ditch. A sump collects the water from the barns’ perimeter tiles and drains it into the tile line, which is connected to the nearby ditch. Thirty-three tile inlets are located throughout the land application
sites. These tile inlets drain to private ditches and then into JD 9. Tile inlet locations are shown in Figure 3-12.

Impacts from contaminated storm water are expected to be minimal at the Nohl facility. Hogs and manure remain inside the barns at all times, minimizing contact with storm water. Storm water from the site is conducted via overland flow west of the barn and remains on Nohl property or flows to the catch basin and to the private ditch.

There are no natural surface waters within the vicinity of the feedlot site or land application areas. A private ditch immediately adjacent to the feedlot connects to JD 9. JD 9 flows through the land application areas. As long as manure is applied at agronomic rates and required setbacks are followed, minimal impacts are expected.

The storage capacity for the site exceeds the average total annual volume of manure generated. The land application areas appear to be sufficient to apply all the manure generated yearly.

Nohl uses a licensed manure application service, Gibson Waste Removal. Gibson Waste Removal adds the pit additive, Liqui-blue™ to the concrete pits at a rate of 5 gallons per year. Potential impacts from this additive were discussed in Section 4.3.1.2 and are not likely to impact surface waters at this facility.

Hog carcasses are composted at this site at a location approximately 100 feet south of the barn. This location is approximately 600 feet from the private ditch. Inspections by the BAH have indicated that the compost pile meets the BAH requirements except the pad is inadequate due to the presence of sandy soils. BAH is currently working with Nohl to improve the pad beneath the compost pile. The finished compost is applied to a nearby field.

4.3.1.5 Olson

Two TIs drain directly to JD 9, which flows through the middle of the Olson farm. Surface water receptors are shown in Figure 3-13. No surface waters are located within 1/2 mile of the facility or its land application areas.

JD 9 is over 500 feet to the east of Barn #3 (See fig. 2-15). Runoff from the feedlot property is directed to the southeast and southwest. Due to the small number of hogs on the feedlot, and the distance from open surface water, significant storm water impacts are not expected.

Scrape and haul from the barns occurs approximately once a week. Manure is applied during winter as long as conditions allow it. If conditions are unfavorable, Olson temporarily stockpiles the manure at the feedlot. The manure applied in the winter is incorporated before planting season begins (after snow melt). Impacts to surface waters for this site may be increased due to
longer periods of manure exposure to precipitation during winter and the potential for drainage from the TIs.

Hog carcasses are composted at this facility. BAH inspection found that not enough bulking material was used and there was insufficient cover. Otherwise the compost site met the BAH requirements. BAH is working with Olson to remedy the deficiencies. The finished compost is applied to a nearby field.

4.3.1.6 Paul

The barn’s perimeter tiles drain into a vegetated buffer area prior to discharging to a wetland located 800 feet away. There are thirty TIs in the land application areas associated with the Paul feedlot. The drainage from the TIs is into the nearby intermittent streams that eventually drain to the Pomme de Terre River, or to small wetlands, except for the manure land in section 15, Moore Township, which drains to JD 9 and the Chippewa River. Surface water receptors are shown in Figure 3-14.

Impacts from contaminated storm water are expected to be minimal at the Paul facility. Hogs and manure remain inside the barn at all times, minimizing contact with storm water. Storm water from the site is conducted via overland flow to adjacent fields east and south of the barn and remains on Paul property.

Impacts to the nearby wetland and the Pomme de Terre River from the Paul site are unlikely as long as proper setbacks and agronomic application rates are followed.

The storage capacity for the site exceeds the average total annual volume of manure generated. The land application areas appear to be sufficient to apply all the manure generated yearly.

Paul previously buried animal carcasses on the site, but in the fall of 2001 he changed to composting. The compost pile was located on the south side of the nearby wetland, in a flowpath directly between fields and the wetland. The pile did not comply with the prescribed setback from open water. For this and other reasons, the construction of the compost pile was not in compliance with BAH requirements. Paul has since removed the compost pile and applied the finished compost to the fields. Paul reports that animal mortalities now are rendered.

4.3.1.7 Schaefer

There are 31 TIs located on the Schaefer site and associated land application areas. One TI is located between the two HPP barns. Runoff from the site discharges into a vegetated area before reaching the TI. Perimeter tiles located around the concrete pits drain to the road ditch. The
remaining TIs are located throughout the land application areas and drain into private ditches that eventually connect to JD 9.

Impacts from contaminated storm water are expected to be minimal at the Schaefer facility. Hogs and manure remain inside the barn at all times, minimizing contact with storm water. Storm water from the site is conducted via overland flow to adjacent fields and remains on Schaefer property or is directed to the vegetated catch basin before entering the TI.

There is farmable wetland on the Schaefer property and an intermittent stream to the southwest of the site. There are no other surface waters within 1/2 mile of the facility or land application areas. Locations of surface water receptors are shown Figure 3-15.

The storage capacity for the site exceeds the average total annual volume of manure generated. The land application areas appear to be sufficient to apply all the manure generated yearly.

Prior to the HPP project, the Schaefer operation was strictly a scrape and haul operation. Stockpiling of manure does occur when necessary at this facility. The manure is usually scraped and hauled directly to fields. However, since the start of the HPP project, the amount of manure from scrape and haul operations has been reduced from 5 tons annually to 0.5 tons annually. The barns with concrete floors are only used to house “slow growers” and other hogs culled from the herd.

Schaefer uses a licensed manure application service, Gibson Waste Removal. Gibson Waste Removal adds the pit additive, Liqui-blue™ to the concrete pits at a rate of 5 gallons per year. Potential impacts from this additive were discussed in Section 4.3.1.2 and are not likely to impact surface waters at this facility.

Hog carcasses are composted at this facility. MPCA inspection noted that additional bulking material was necessary to cover the carcasses properly, and the compost pile was not operated correctly. Schaefer is currently working with the BAH to comply with requirements. The finished compost is applied to a nearby field.

4.3.1.8 Solvie

One TI is located within the area available for land application of manure. The TI outlets to the road ditch immediately adjacent to the property. The ditch eventually drains to a nearby unnamed wetland. Several surface waters and the Chippewa River are located either within 1/2-mile of the facility or in land application areas. Surface water receptors are shown in Figure 3-16. Solvie reports following required setbacks from sensitive features. As long as this practice is continued and manure is applied at agronomic rates, minimal impact to surface waters is expected.
Hogs and manure remain inside the barn at all times, minimizing contact with storm water. The manure basin is always exposed to contact with storm water and the contents are applied to fields with manure. Storm water from the buildings is conducted via overland flow to adjacent fields southwest of the barns and remains on Solvie property. Impacts from contaminated storm water are expected to be minimal at the Solvie facility as long as the manure basin is not allowed to overflow.

Prior to the HPP project, the Solvie operation involved scrape and haul operation as well as basin storage. The scrape and haul operation has been nearly phased out. The barn with concrete floor is only used to house hogs culled out of the herd, and only a minor volume of manure is generated there.

The storage capacity for the site exceeds the average total annual volume of manure generated. The land application areas appear to be sufficient to apply all the manure generated yearly.

Solvie uses a licensed manure application service, Gibson Waste Removal. Gibson Waste Removal adds the pit additive, Liqui-blue\textsuperscript{TM} to the concrete pits at a rate of 5 gallons per year. Potential impacts from this additive were discussed in Section 4.3.1.2 and are not likely to impact surface waters at this facility.

Solvie at one time composted mortalities, and the compost pile was reported by BAH to be operated according to BAH requirements. According to HPP, Solvie no longer composts, and uses rendering exclusively at this time.

4.3.1.9 Spohr

Twenty-nine TIs are located within land application areas for this facility. Storm water runoff from the site discharges into a grassy area before reaching a nearby. The TIs in Section 31, Horton Township drain to a small stream that discharges into the Pomme de Terre River. The remaining TIs drain into small wetlands or overland into neighboring fields. The TIs are checked for clogging and debris 4 times a year. If debris is found, it is removed and the tile function is restored. A surface water is located near the feedlot site but manure is not applied to fields near it. Locations of surface water receptors are shown Figure 3-17.

The HPP barn at the Spohr feedlot has a concrete storage pit with a total volume of 435,000 gallons. This is larger than the annual volume of manure produced at the site. Perimeter tile around this pit drains to the road ditch referred to above. The sump drains to a grassy area near the barn via overland flow.

Impacts from contaminated storm water are expected to be minimal at the Spohr facility. Hogs and manure remain inside the HPP barn at all times, minimizing contact with storm water. The
barns and open lots used for horses, chickens, and injured hogs have scrape and haul operations performed as needed. Storm water from this area is directed through pathways between feedlot buildings. Storm water from the site is conducted via overland flow to adjacent fields and remains on Spohr property.

Since the start of the HPP project, the amount of manure from scrape and haul operations has remained constant at approximately 150 tons annually. The barns with concrete floors are only used to house culled hogs, chickens and horses.

Spohr uses a licensed manure application service, Gibson Waste Removal. Gibson Waste Removal adds the pit additive, Liqui-blue™ to the concrete pits at a rate of 5 gallons per year. Potential impacts from this additive were discussed in Section 4.3.1.2 and are not likely to impact surface waters at this facility.

Hog carcasses are composted at this facility on an old barn open lot. The inspections by MPCA and BAH indicate that the site is compliant. The finished compost is applied to a nearby field.

4.3.1.10 Zeltwanger

Twenty-nine TIs drain to private ditches that eventually lead to unnamed wetlands or other private ditches. A National Wildlife Management Area is located within 3/4-mile of the facility. Surface water receptor locations are shown on Figure 3-18.

Stormwater runoff from the feedlot site is directed to the northwest towards the adjacent fields. Due to the small number of hogs on the feedlot, and site drainage that diverts water away from the barn areas and through vegetation prior to flowing into a field, storm water impacts are expected to be minimal. The short-term stockpiling area is a concrete pad, and is used only when conditions do not allow direct hauling to application fields. Drainage from this pad is through a vegetated area to a field.

The Zeltwanger facility is strictly a scrape and haul operation. Scrape and haul from the barns occurs approximately once a week. Manure is applied during winter as long as conditions allow. If conditions are unfavorable, Zeltwanger temporarily stockpiles the manure on a concrete pad. The manure applied in the winter is incorporated before planting season begins (after snow melt).

No surface waters lie near the feedlot, or within land application fields.

Hog carcasses are picked up by a rendering service at this facility. No impact to surface water is apparent from the mortality storage area. Inspection from the MPCA and BAH indicate site compliance with appropriate requirements.
4.3.2 **Cumulative Effects**

Cumulative effects within the project area would be potential excess nutrient and suspended solid loading within surface waters if setbacks and agronomic application rates are not followed.

The MPCA Detailed Manure Management Review and the MPCA Compliance Report (*Appendices F and G*) indicate that the farrowing facility and associated finishing sites are in compliance with requirements for applying manure at recommended agronomic rates and the applicants report that they comply with required setbacks from sensitive features. Impacts to surface water from these sites are minimized as long as reported practices are continued.

4.4 **WILDLIFE AND HABITAT**

The habitat in which the HPP project has been built was severely altered before the construction and operation of the project. The North Central Hardwood Forest (NCH) and Northern Glaciated Plains (NGP) ecoregions have been used extensively for agriculture and other purposes. Over 50% of the original wetlands have been drained by some estimates and converted to agricultural fields (Heiskary and Wilson 1989; Waters 1977). Little natural habitat remains due to conversion from the grasslands present over 100 years ago. The areas directly affected by the HPP project are largely cropland. Habitat disruption resulting from construction of the barns or of future barns for the project is or will be in previously altered fields occupied by few species.

The Danvers State Wildlife Management Area (Danvers WMA) is approximately 5 miles south of the HPP project sites. This area is of concern because runoff from some of the HPP sites is directed into JD 9. When JD 9 was originally built, it flowed through the Danvers WMA (MDNR 1993). In 1986, CD 83 was constructed, diverting the flow from the Danvers WMA and directing it into the Chippewa River, south of Benson. Overflow during times of high flow may enter the Danvers WMA but only minimal amounts of baseflow from CD 83 enter the wetland (MDNR 1993). Potential impacts to the Danvers WMA due to contaminated runoff from the HPP sites are therefore considered to be minimal.

Disease transmission to wildlife from pathogens contained in the manure spread on to fields has impact potential. The GEIS Technical Work Paper for Animal Health (Halverson 2001) refers to studies conducted in Europe identifying that liquid manure spreading can increase infection of wildlife habitat from feedlot sources. Pathogens, viruses, and other microorganisms present within manure may infect wildlife, such as deer that graze on the plants growing in manure treated soil. The World Health Organization identified liquid manure land application as a critical pathway for salmonella and other pathogens (Addis *et al* 1999). There is no evidence that this is occurring in the vicinity of the HPP project.
Potentially, vectors such as flies are thought to have the potential to transmit disease. This topic is in its infancy with regards to research. The literature databases of the USDA, EPA, MPCA, and Universities of Pennsylvania, Minnesota, Ohio, and Iowa were searched for any studies or ongoing research documenting disease transmission from feedlots to wildlife from vectors. Literature searches of these databases produced limited information on the topic. According to Minnesota Public Radio's transcript of its broadcast, 'The Invisible Web', one study suggested that resistant bacteria were present in wild Canadian geese populations (Losure 2000). However, how geese were exposed to the bacteria was not discussed. There currently is concern that altered proteins known as prions, which are thought to cause chronic wasting disease in elk farms, may be passed to wild deer populations from elk farms.

Disease transmission may also occur if animal mortalities are improperly managed. Wild animals such as eagles and coyotes may scavenge the carcasses and either contract diseases themselves or become carriers of pathogens and spread them in the environment. Flies near composting or burial sites may potentially transmit diseases present within the mortality material to wildlife, but the literature available on disease transmission in this manner is limited. Pathogens are known to be destroyed by composting, so finished compost is probably an insignificant source of diseases. Appropriate mortality management would minimize the potential for disease transmission to scavenging animals or for vector transmission.

Surface water run off may affect aquatic biota by carrying with it pathogens or harmful chemicals in addition to the nutrients addressed in Section 4.2. The harmful chemicals are typically pharmaceutical agents that are used on the animals and include antibiotics, hormones, and other medicines. A percentage (variable but often more than 25%) is excreted by animals without being metabolized (Wallinga 2002; see also Raloff 2002). Thus, manure may contain appreciable amounts of pharmaceutical chemicals that could impact plants and animals that come into contact with it. However, there is no evidence that any pharmaceutical use at HPP sites is contributing significantly to any such impact.

Bacteria and viruses present within liquid manure may cause illness or disease in certain species of wildlife. *Pfiesteria piscicida* (a dinoflagellate that can release nerve toxins) has been attributed to the presence and operation of poultry and hog feedlots. *Pfiesteria piscicida* is known to occur in brackish coastal waters from the Delaware Bay to North Carolina where nutrient concentrations are high (USEPA ND). Other *Pfiesteria*-like organisms occur along the southeast coast from Delaware to the Gulf of Mexico. These organisms are believed to be native, not introduced species, and are probably common inhabitants of estuarine waters within their range. These microbes have not been found in freshwater lakes, streams, or other inland waters, and are not known to exist in the HPP area.
Potential impacts to fish from endocrine disruptors are of more immediate concern. These are chemicals thought to originate in domestic wastewater or other waste disposal systems (e.g., feedlots) that can mimic or disrupt hormonal functions in organisms. The exposure pathway is generally waste discharge to surface waters that are then consumed by animals or humans. Endocrine disruptors have been definitively linked to mutations in the reproductive systems of alligators, minnows, and other animals (Raloff 2002; Kamrin 1999), and levels of these substances known to cause such effects have been found in US surface waters (Kolpin et al 2002). A European Union-funded study in Nebraska found that endocrine disruptors originating from feedlots were impacting minnows downstream, causing female minnows to exhibit male reproduction characteristics and males to exhibit mutated reproductive characteristics (Raloff 2002). USEPA (1997) reviewed the problem from a “big picture” perspective. No chemicals are in use at HPP sites that are known to act as endocrine disruptors.

4.4.1 Site Specific Effects

With the exception of the Solvie site (see Section 4.4.1.8), the potential for impacts caused by HPP facilities to habitat or species that are endangered or of special concern as identified by the Minnesota Natural Heritage and Nongame Research Program (NHNRP) are minimal. Impacts on habitat and wildlife from new construction or land application areas are discussed in the following sections.

The MDNR-Glenwood does not believe that the impacts from manure land application will directly affect resident wildlife within the HPP project area as long as excess nutrients are not allowed to reach surface water. Typically, the resident wildlife are prairie birds and mammals, and fish within the surface waters. There is a concern regarding potential effects on fish populations if excess nutrients would reach surface waters, but this should not happen if manure is managed and applied according to the rules.

4.4.1.1 Farrowing Facility

The farrowing facility and associated land application areas are located near two naturally occurring surface waters, in addition to JD 9. JD 9 flows approximately 9 miles from the farrowing facility property before being diverted into CD 83 just before reaching the Danvers Wildlife Management Area (WMA). CD 83 flows from the Danvers WMA vicinity for an additional three miles before entering the Chippewa River. The MDNR-Glenwood did not express concern for wildlife or habitat within the farrowing facility property and associated land application sites as long as appropriate manure management practices are followed.

The farrowing facility injects its manure when land applying, thereby minimizing risk of contact with wildlife that may be the vicinity. The facility has a rendering service pick up dead animals.
or incinerates its animal mortalities. Feedlot operation and land application practices in place at the facility should have minimal impact on the habitat and surrounding wildlife.

4.4.1.2 Charles

The Charles finishing site and proposed manure land application sites are located west of a federal waterfowl production area (WPA) near the town of Hancock. However, the WPA will most likely not be affected by the feedlot operations.

Charles plans to inject manure when land applying, thereby minimizing risk of contact with wildlife that may be in the vicinity. The facility would compost its animal mortality in an enclosed silo according to prescribed practices, thereby reducing the potential for wildlife scavenging through carcasses. Feedlot operation and land application practices would conform to regulatory requirements and would therefore have minimal impact on habitat and surrounding wildlife.

4.4.1.3 Greiner

The Greiner finishing site and land application fields are located near Lake Emily and the Greiner WMA. The MDNR expressed a general concern with manure land application impact potential, but according to interviews with the Greiners and information submitted by them, the feedlot will have minimal impact on the Greiner WMA, so long as land application setbacks are followed and agronomic rate manure application is practiced.

The Greiners inject manure when land applying, thereby minimizing risk of contact with wildlife that may be in the vicinity. The facility uses a rendering service to handle its animal mortalities. The operational and land application practices in place at the facility should have minimal impact on the habitat and surrounding wildlife.

4.4.1.4 Nohl

The Nohl finishing site and associated land application areas are located near JD 9. JD 9 flows approximately 9 miles and diverts into CD 83 just before reaching the Danvers Wildlife Management Area (WMA) and eventually enters the Chippewa River, an additional 3 miles from Danvers WMA. The DNR-Glenwood did not express concern for these areas and associated wildlife within them with regard to effects from finishing site activity.

Nohl injects manure when land applying thereby minimizing risk of contact with wildlife that may be in the vicinity. The facility composts its mortalities. However, inspections by MPCA and BAH identified the potential for animals scavenging in the compost pile due to inadequate cover. Nohl does not report any problems with animals scavenging in his pile and is working with the BAH to improve his compost operation. Feedlot operation and land application
practices in place at the facility should therefore have minimal impact on the habitat and surrounding wildlife.

4.4.1.5 Olson

The Olson finishing site and associated land application areas are located near JD 9. JD 9 flows approximately 10 miles and diverts into CD 83 just before reaching the Danvers Wildlife Management Area (WMA), and eventually enters the Chippewa River, an additional 3 miles from Danvers WMA. The MDNR-Glenwood did not express concern for these areas and associated wildlife within them with regard to effects from finishing site activity.

The facility composites its animal mortality. There may be a potential incidence of animals scavenging in the compost pile due to inadequate cover, but Olson is working with the BAH to improve his operation. Feedlot operation and land application practices in place at the facility should have minimal impact on habitat and surrounding wildlife.

4.4.1.6 Paul

The Paul finishing site is located approximately 800 feet from a wetland. Drainage from the feedlot is ultimately directed towards the Pomme de Terre River that is located several miles from the feedlot site. Drainage from land application fields also flows to the Pomme de Terre River, with the exception of one field in section 15, Moore Township that drains to JD 9 and the Chippewa River. One land application site is located immediately adjacent to the Pomme de Terre floodplain.

The facility injects its manure when land applying, thereby the minimizing risk of contact with wildlife that may be in the vicinity. The facility formerly buried or composted its mortalities, but currently renders its animal mortalities. Feedlot operation and land application practices in place at the facility should have minimal impact on habitat and surrounding wildlife.

4.4.1.7 Schaefer

The facility injects its manure when land applying, thereby minimizing risk of contact with wildlife that may be in the vicinity. The facility composites its animal mortality. An inspection by MPCA identified the potential for animals scavenging in the compost pile due to inadequate cover. Schaefer does not report any problems with animals scavenging in his pile. BAH is currently working with Schaefer on compost practices. Feedlot operation and land application practices in place at the facility should have minimal impact on the habitat and surrounding wildlife.
4.4.1.8 Solvie

The Solvie feedlot is over a mile from the Chippewa River. Solvie owns land immediately adjacent to the Chippewa River, but does not apply manure there. The DNR NHNRP identified two species of mussels (Black Sandshell and Creek Heelsplitter) believed to inhabit the area both upstream and immediately downstream of the Solvie feedlot. The DNR NHNRP has expressed concern that land application and increased contaminated runoff may impact the existence of these species of special concern due to their sensitivity to increased siltation. The DNR-Glenwood also expressed a general concern about wildlife in this vicinity being affected if manure and additional runoff were to enter the Chippewa River. Since the feedlot is over a mile away and the land near the river is not used for manure disposal, the Solvie facility should pose a minimal threat to the above species.

The DNR NHNRP recommends that the facility take precautions to control contaminated runoff from the land application fields. Adherence to the required manure application setbacks would minimize the impacts to wildlife in the vicinity.

The facility uses a rendering service to manage mortalities.

4.4.1.9 Spohr

No protected waters or intermittent streams are located within the Spohr feedlot and associated manure application fields. However, a wetland is located across the road from the finishing site. The road provides a barrier to potential impacts on wildlife that may use this wetland. The MN DNR-Glenwood expressed a general concern about wildlife in this vicinity being affected if manure and additional runoff were to be not properly managed. Conversations with the operator indicate that the appropriate practices are employed.

The facility injects its manure when land applying, thereby minimizing risk of contact with wild animals that may be in the vicinity. Inspections of the facility have noted adequate cover used in the compost pile. Spohr does not report any problems with animals scavenging in his pile. Feedlot operation and land application practices in place at the facility should have minimal impact on the habitat and surrounding wildlife.

4.4.1.10 Zeltwanger

No protected waters are located within the land application fields or in the vicinity of the finishing site. There is however, a federal waterfowl production area located within ½-mile of a land application field (no TIs present) specified for use for land application of manure. Conversations with the operator indicate that the required setbacks are followed and minimal impacts to wildlife in the area are expected.
The facility landspreads the solid manure every week and does not incorporate the manure within 24 hours. The facility uses a rendering service to handle its animal mortality.

### 4.4.2 Cumulative Effects

Cumulative ecological effects should be minimal as long as reported manure application practices are continued and compost piles are managed according to BAH rules.

### 4.5 Human Health

Pathogens. Pathogens are known to be emitted from livestock buildings (Homes et al 1996), and they theoretically can cause disease in people living nearby. However, no direct evidence for this currently exists. Disease transmission to humans directly associated with feedlots via contact with contaminated soil or water or from crops in land application areas is thought to be rare. Diseases for which domestic animals are the primary host are primarily an occupational hazard for those working with animals or animal products (Earth Tech 2001a). Some incidences of human disease attributable to contact with livestock waste have been reported. However, these are more typically associated with food infections. There is no evidence that pathogens from HPP sites are causing disease in humans. A study of sufficient rigor to confirm this would likely be prohibitively costly and time consuming, however.

Pathogen resistance. Antibiotic resistant bacteria that may be transferred to humans comprise another concern with human health. The evidence seems clear that routine subtherapeutic use of antibiotics for growth promotion and disease prophylaxis at feedlots is contributing to this problem. The trend in Europe is to limit or ban the practice for this reason. The HPP facilities all use antibiotics in this way, and this use is typical of feedlots in the US.

There is no evidence, however, that the HPP facilities individually contribute significantly to this problem. No evidence surfaced during this EIS process that HPP was causing a specific pathogen resistance issue, and specific studies and surveillance to seek such evidence or rule it out could be quite costly and time consuming. At least, there have been no known cases of resistant infections in people in the area or in other ways connected to HPP or its products. A number of recent studies reported in the New England Journal of Medicine and elsewhere (see for example White et al 2001) report that resistant bacteria have been found within retail ground meats bought at supermarkets, and the Taiwan study cited earlier (Cheng-Hsun Chiu et al 2002) tied hospital cases of resistant disease directly to the feedlots of origin. However, no information like this exists for the HPP project. Perhaps more importantly, neither of the above studies called for subtherapeutic use of antibiotics to be eliminated at the specific facilities that were implicated, but instead called for an ultimate end to the practice industry-wide.
Some research exists on a method for slowing the development of antibiotic resistance, although the authors make it clear that this method will not solve the problem once and for all (Pittendrigh et al 2000).

**Chemicals.** No evidence was found in the literature that metal-containing compounds used at feedlots have caused adverse effects in humans. No known endocrine disruptors are used in HPP feedlot management.

**Airborne particulates.** Feedlot dust may contain any or all of the following: microbes, endotoxins, animal dander and hair, fecal matter, feed particles, and common soil. Available evidence indicates that such material is more of an occupational than environmental hazard (see for example Earth Tech 2001a). Numerous studies have documented adverse health effects of feedlot dust on feedlot workers. The potential accordingly exists for feedlot dust that is emitted from buildings into the environment to affect neighbors, but Addis et al (1999) found no research in the literature on impacts of feedlot dust emissions downwind of animal facilities in the Midwestern US. No evidence surfaced in this EIS process that dust from HPP facilities was causing adverse effects in the vicinity. A study of sufficient rigor to confirm this would likely be prohibitively costly and time consuming, however.

**Vector-borne pathogens.** Flies commonly associated with feedlots can acquire and transport disease organisms. However, it remains to be demonstrated that flies are significant in the transmission of disease from feedlots to the surrounding community (Addis et al 1999). There is no evidence that this is a problem at the HPP facilities. A study of sufficient rigor to confirm this would likely be prohibitively costly and time consuming, however.

**Odors.** Manure has been found to contain at least 168 volatile odorous compounds, and at least 26 of these have been found in the gaseous state in feedlot emissions (O’Neil and Phillips 1992) (other investigators have found more; Schiffman et al (2001), for example, found 331 different volatile odorous compounds in manure). In addition to its well-documented propensity for causing annoyance, odorous gases can cause human health impacts as well. Some VOOCs have been identified as respiratory tract, eye, or skin irritants (Addis et al 1999). Schiffman et al (1995) showed that feedlot odors can adversely affect the mental and emotional state of humans as well. There is, however, currently a great deal of uncertainty regarding the extent to which physical and mental effects result from direct chemical actions on tissues as opposed to learned aversion and the association of unpleasant sensations with objectionable odors. Odor related impacts can and do occur at air concentrations below the level of toxic exposure (Addis et al 1999); put differently, people can smell and be annoyed by odors at levels below those that would cause toxic effects.
There seems to have been little research aimed at comparing emitted concentrations of individual feedlot gases with concentrations shown to cause health effects; most such studies have focused on odor annoyance rather than health effects.

The ability of this EIS to address this issue is correspondingly limited. It is limited further by the fact that, as a cost cutting measure mandated by EQB, MPCA analyzed odor dispersion from the HPP facilities as a combination of odorous gases (rather than modeling the dispersion of each VOOC in isolation), and compared the results with the concentrations found by Zahn (1997) to be unpleasant to an odor panel (rather than comparing downwind concentrations of the individual VOOCs to threshold odor detection values from the scientific literature). Individual VOOCs were measured at each site, but were then combined at the laboratory into a single input value for the modeling analysis; the dispersion of this mixture was then modeled.

This means that this EIS analysis was not designed to predict the dispersion of individual gases away from the sources, and accordingly did not predict the concentrations of individual VOOCs at the fence line or at the nearest receptor. The analysis thus produced no values that can be compared with any of the available health benchmarks (few as they are).

A search of available resources (Gantzer 2003, personal communication) identified a small amount of data on measured concentrations of the same VOOCs as were measured at the HPP sites, downwind from a highly odorous (non-HPP) manure storage basin, measured by Zahn et al (1997) (it must be remembered that the HPP sites largely use deep pits, not earthen basins). The measurements were taken 100 meters from the basin, and are presented in Table 4-81. This table compares those emission concentrations with the few available reference concentrations that were found. Note that all of the concentrations measured 100 meters away from this highly odorous basin are below the reference values with the exception of the propanoic acid concentration, measured at 1140 ug/m^3, which exceeds the proposed Wisconsin 24-hour ambient air quality standard of 727 ug/m^3.

However, in order to make these numbers directly comparable, the fact that they are the result of different averaging times must be taken into account. The proposed Wisconsin standard is a 24-hour average, meaning that concentrations exceeding 727 ug/m^3 are acceptable in any 24-hour period as long as lower concentrations to offset them occur during that period as well. The concentration measured by Zahn was averaged over 15-30 minutes, and thus represents a more immediate snapshot of the propanoic acid concentration near the earthen basin.

The conversion factors that allow comparisons of different averaging times are somewhat problematic. As a crude approximate, USEPA (1992) suggests multiplying the hourly concentration (the measured Zahn number, in this case) by 0.4 to convert the hourly value to a
24-hour concentration. Doing this gives 456 ug/m³, which is below the proposed Wisconsin 24-hour ambient standard.

The available evidence, then, does not indicate that VOOC emissions from the HPP sites would cause significant toxic exposure potential. It must also be remembered that this analysis is subject to a number of qualifiers:

- The reference values are mostly from other states, and may not be relevant to circumstances in Minnesota.
- The EPA conversion factor used above is at best a crude approximation of the difference between a 30-minute average and a 24-hour average, and is intended for use with hourly averages, not half-hour averages.
- The concentrations measured by Zahn came from a particularly odorous earthen basin, where emissions were likely considerably higher (and possibly different chemically) than those coming from the HPP sites, where manure is mostly stored in deep pits. It was, for example, found that replacing the old earthen basin at the Spohr site with a deep pit considerably reduced modeled emissions from the site.

### 4.5.1 Cumulative Effects

**Water.** The MPCA Detailed Manure Management Review and Compliance Report (see Table 4-82) indicate that prescribed land application practices are generally followed at the HPP project feedlots. This minimizes the risk of transport of contaminants off site to ground or surface waters, as long as practices reported are followed in the future. The risk of surface water receiving detectable levels of contaminants from project land application fields is minimized through adherence to manure application setbacks and recommended manure application rates. Chemicals used at the HPP feedlots are not known to act as endocrine disruptors. Cumulative public health impacts are therefore unlikely.

**Airborne particulates and odors.** Based on the foregoing, there is little reason to suspect that these contaminants represent a significant cumulative threat to public health.

**Antibiotic resistance.** Subtherapeutic use of antibiotics is practiced at all HPP facilities. Pathogen resistance to antibiotics is clearly occurring nationwide, and subtherapeutic use of antibiotics at feedlots clearly contributes to the problem. The GEIS documents dealing with human health issues (Addis et al 1999; Earth Tech 2001) document increasing concern about this issue, as well as calls from a variety of entities for the elimination of subtherapeutic use of antibiotics. However, the HPP contribution is probably not significant on an individual basis; the problem exists because such use is routine nationwide. The relevant scale for considering the
The cumulative effects of subtherapeutic use of antibiotics at feedlots is the entire industry. Eliminating such use at any one site will not eliminate the problem, and by definition cannot address the industry-wide impact of this practice. Earth Tech (2001), noting that action by the state of Minnesota acting alone may be illegal and would likely not be effective in the context of nationwide use, recommends increased surveillance and tracking of use, labeling, and support of federal initiatives to protect drugs used in humans from development of resistance.

**Greenhouse gases.** As noted above, the greenhouse phenomenon is a global issue that mitigation at feedlots on an individual basis cannot resolve. A programmatic, global approach is needed to address this issue. Individual feedlot projects probably do not contribute significantly to the problem.

### 4.6 Socioeconomic Issues

#### 4.6.1 Land Use Compatibility

The HPP project is developed in an area that is zoned agricultural. The proposed project components do not require issuance of conditional use permits for the animal agricultural activities envisioned by the project.

The Minnesota Historical Society, State Historic Preservation Office was contacted in July 1997 to determine if the HPP project would potentially impact the cultural resources in the area. At that time, there were no known or suspected archeological properties that would be affected by the project. The State Historic Preservation Office was contacted again in September 2002 to confirm the assessment. The State Historic Preservation Office indicated that their opinion had not changed. The referenced correspondence can be found in Appendix F.

There are no schools, parks, churches, cemeteries, or other public access facilities within one mile of any of the HPP feedlots. The only public structures or facilities near any of the sites are the public roadways near each site.

There are numerous pre-existing odor sources present in the HPP project area. Those odor sources include pre-existing feedlot operations. Gantzer Environmental included these odor sources in the background odor assessment that is part of the air-modeling component of the EIS. The locations of the various odor sources that were modeled are shown on Figure 3-1.

#### 4.6.2 GEIS Findings on Socioeconomic Issues

##### 4.6.2.1 Social

Wright *et al* (2001) assessed the relationship between animal agriculture and the way in which people live, work, relate to one another, organize to meet their needs, and generally cope as
members of society. They concluded that changes in animal agriculture in Minnesota clearly have an impact on society. These impacts were uneven within the context of an individual’s physical and social proximity to animal agriculture, and were considered negative or positive depending on one’s involvement in the agricultural industry. The impacts identified and analyzed involved (1) changes in animal agriculture; (2) quality of life; (3) community interactions; (4) future of animal agriculture; and (5) changes in population dynamics. Please refer to Wright et al 2001 for the full discussion.

4.6.2.2 Economic

According to the USDA, Minnesota’s pork industry is the third largest in the United States. The Minnesota Pork Producers (MPP) consider the economics of the pork industry to extend to feed production, manufacturing, implement supplies, transportation, utilities, wholesale and retail, banking, insurance, and other supply service-oriented businesses. According to the State of Minnesota’s Department of Agriculture (MDA), for every new position of employment in the pork industry, approximately 1.2 other jobs are created.

MDA (2002) recently performed a modeling study to estimate the direct, indirect, and induced economic impact of selected Minnesota livestock processing plants on their local and state economies. This study modeled combined economic impacts on those economies in the billions of dollars annually, depending on the assumptions in the modeling exercise.

The economic elements discussed in the state’s GEIS on feedlots (Lazarus 2001) included agriculture structure and competitiveness. Topics included the number, location, and nature of feedlots; the business structures used by livestock operations; the ownership and control of livestock operations; the present market situation; and the competitiveness of Minnesota livestock producers in the national and international markets. The GEIS also attempted to assess the positive and negative economic effects of animal agriculture on other industries and businesses, communities, and the state as a whole.

The economic impacts of agriculture can be assessed in part by reviewing average employment by industry sector, average annual wage by industry, and the history of existing and projected agriculture feedlots. Employment-by-industry data for Stevens and Pope Counties is shown in Table 4-81. In total, the area supported more than 7,982 jobs in 1996. Of the industry sectors, service, trade, and government are the largest employers with a total of 5,850, almost seventy-five percent of the total jobs. Manufacturing would be the fourth-largest employment sector with 1,124 jobs.
The agricultural sector clearly has a presence in both counties, employing 319 people. As discussed earlier in this EIS, many additional sectors benefit from agricultural activities. In the short-term, the proposed project created several construction jobs. As the feedlots continue to operate and compete with hog production in other areas, they will maintain and possibly create jobs in the trade, manufacturing, transportation, and service sectors in the region.

4.6.2.3 Relevance to Hancock Pro Pork Project

The population, employment, and household projections are included in Table 4-82 for Pope and Stevens Counties. According to the Minnesota Planning Agency, over the next twenty years, Stevens County should experience a moderate decrease in population, a moderate increase in housing, and a moderate decrease in employment. Pope County is also expected to lose some of its population and see a decrease in both housing and employment during the next twenty years.

Social. No evidence was found to indicate that implementing the HPP project would have significant effects of the type identified in the GEIS. There is no indication that the surrounding area’s “social capital” has been affected by the project. The limits placed on the socioeconomic analysis by the EQB-ordered resolution of the cost dispute precluded an in-depth study of site-specific social effects.

Economic. Implementing the proposed project will probably not significantly impact populations, households, or employment in Stevens or Pope Counties. The limits placed on the socioeconomic analysis by the EQB resolution of the cost dispute precluded an in-depth study of site-specific social effects. The trend in hog farms in both Pope and Stevens Counties during the past twenty-five years (525 in 1978 and 127 in 1997) might continue. The size of the remaining farms will probably increase until the economy of scale is achieved. The trend occurring in Minnesota, including Pope and Stevens Counties, is a reduction in total number of farms along with an increase in the total number of animals per farm.

4.6.2.4 Summary of Social and Economic Impacts Requiring Mitigation

This section considers those impacts that have the potential for imposing induced or secondary effects on surrounding communities as a result of feedlot development. It includes any shifts in patterns of population movement and growth as well as changes in business and economic activity caused by the development of the feedlot.

Based on the size of the project, impacts to businesses, recreational areas, and surface transportation are expected to be minimal since the area has been used for agricultural purposes for the past several decades. Those area businesses currently in the agriculture business would
not be significantly affected by the project. **Section 4.6.2** discussed the economic impacts of the proposed project and **Section 4.6.1** discusses compatible land uses.

For residents near the operation, the EIS findings would suggest that there are possible odor issues that would warrant review and/or mitigation.

### 4.7 Site Specific Compliance – Manure Management/Feedlot Operations

In this section, feedlot compliance is judged against the feedlot rules in effect before October 23, 2000 as well as the revised feedlot rules currently in effect. The previous and revised feedlot rules are summarized in **Section 2.4**. Permit issuance at specific sites may not be complete due to the EIS process.

A Detailed Manure Management Review (summarized in **Appendix F**) was conducted by the MPCA during October 2002 for all sites that are in operation in the HPP Project. The purpose of the review was to determine the level of compliance at the HPP feedlot operations regarding manure and soil testing, manure application to fields, and record keeping practices. A Compliance Inspection Report (**Appendix G**) was prepared by the MPCA to determine compliance with feedlots rules.

Additionally, the Board of Animal Health (BAH) has also inspected the HPP feedlots and determined if sites were compliant with the BAH animal mortality management regulations that the Board enforces.

**Table 4-83** summarizes the Compliance Report and Summary of Detailed Manure Management Review findings for the HPP sites.

#### 4.7.1 Farrowing Facility

The farrowing facility has agreed to comply with the spring manure application conditions in the 1998 Interim Permit, although the permit has expired. In addition to conditions in the Interim Permit, the farrowing facility must comply with any additional requirements in the revised Feedlot Rules (Minn. R. Chapter 7020). The farrowing facility is registered with Stevens County as required by the new state feedlot rules.

The farrowing facility has applied for coverage under the NPDES General Livestock Production Permit (MNG440000) and is currently awaiting approval. The NPDES General Permit is the standard operating permit for a facility with over 1000 AU capacity. The farrowing facility's Manure Management Plan (MMP) was updated, and a new application was submitted to MPCA to comply with the revised feedlot rules. The updated MMP is included in **Appendix B**. The MPCA is currently reviewing the permit documents, but cannot grant approval until the EIS.
process is completed. If the farrowing facility does not qualify for coverage under the General NPDES permit, HPP must apply for an Individual NPDES/SDS permit. The MPCA currently does not anticipate the need for the farrowing facility to apply for an Individual NPDES/SDS permit.

MPCA review of land application practices at the farrowing facility reveal that the site practices are compliant with regulations for manure and soil testing, manure application rates, and adherence to manure application setbacks. The farrowing site uses the land of other farmers for manure disposal. If the farrowing site is to continue to use other farmers’ fields for manure application (such as Olson’s), the farrowing site must have the appropriate field and application information within their MMP, perform field and manure testing, keep the appropriate land application records, and provide the field owners with the appropriate information for their records so that both the farmer and farrowing facility can show that nutrients from all sources were applied at agronomic rates. Therefore, HPP-FF must update their MMP annually and keep the updated MMP and annual manure application records available on site as required. Because HPP-FF has agreed to follow the conditions of the expired Interim Permit, they have been submitting the annual manure application records to MPCA each year.

Table 4-83 details requirements and site compliance with those requirements. HPP reports that it maintains setbacks from sensitive features. There is adequate manure application acreage for manure production at this facility.

Dead animal disposal practices at the farrowing facility appear to be compliant with applicable requirements. The facility's incinerator was earlier found to be non-compliant with Minn. R. 7011.1215 requiring an afterburner that maintains flue gases at 1,200°F for a minimum of .3 seconds. The farrowing facility has since installed an afterburner to bring the incinerator into compliance. Pest control was found inadequate near barns and animal disposal areas during the recent inspection, and this was brought to the operator’s attention. Animal burrows were subsequently filled in and traps were set to control vectors and pests.

Minnesota requirements for manure storage structures, feed storage areas and surface water drainage were met.

The facility has not reported its intent to pump and land apply manure to either Stevens County or the MPCA at least three days before pumping as required by the rules if the facility desires to be exempt from air quality requirements during this operation. The farrowing facility land applies manure by injection, which greatly attenuates air emissions from land application fields (Moseley et al 1998; Hanna et al 2000). Air impacts from fields are expected to be minimal.
4.7.2 Charles

The Charles site has not been constructed. The site's planned operations appear to comply with MN regulations according to the site's initial permit application. Actual compliance with regulations cannot be assessed until the site submits a new permit application in accordance with the new rules.

The Charles facility, if built, would land apply manure by injection, which greatly attenuates air emissions from land application fields (Moseley et al 1998; Hanna et al 2000). Air impacts from fields are expected to be minimal.

4.7.3 Greiner

The site is registered with the Pope County Feedlot Program. Greiner obtained the appropriate approval before construction of the HPP related barn.

MPCA review of the manure and soil testing records showed that they did not meet the requirements for record keeping for facilities with over 300 AU. Field location and approximate application rate information was obtained and reviewed and, based on estimates, nutrient application rates appeared to be in compliance with recommended agronomic rates based on expected crop yields. Greiner is required to keep records by the new rules, and is expected to comply with this requirement in the future. Greiner reports maintaining setbacks from sensitive features. There is adequate manure application acreage for manure production at this facility.

Minnesota requirements for manure storage structures, feed storage areas, pest control, and surface water drainage were met.

During the November 2001 MPCA inspection, agency personnel observed animal carcass residue near the barn although the facility reported that it was rendering mortalities. Greiner clarified that he had recently switched to using a rendering service and that the hog remains observed on the site comprised the old compost pile. During the October 2002 inspection, no hog remains were observed and the site was then termed compliant.

The facility has not reported its intent to pump and land apply manure to either Stevens County or the MPCA at least three days before pumping as required by the rules if the facility desires to be exempt from air quality requirements during this operation. The Greiner facility land applies manure by injection, which greatly attenuates air emissions from land application fields (Moseley et al 1998; Hanna et al 2000). Air impacts from fields are expected to be minimal.
4.7.4 Nohl

The site is registered with the Stevens County Feedlot Program. Nohl obtained the appropriate approval from the Stevens County Feedlot Program before construction of the HPP related barns.

Review of the manure and soil testing records indicate that the requirements for record keeping for facilities exceeding 300 AU capacity are met. Field location and manure land application rate information was obtained and reviewed, and nutrient application rates are in compliance with recommended agronomic rates based on expected crop yields. Nohl reports maintaining setbacks from sensitive features. There is adequate manure application acreage for manure production at this facility.

Minnesota requirements for manure storage structures, feed storage areas, pest control, and surface water drainage were met.

During the November 2001 MPCA inspection, an inadequate amount of cover material was noted on the compost pile. An inadequate amount of cover material was again noted on the compost pile during an October 2002 inspection. In addition, the compost pile is located on granular soil and is within a surface water flow path. Nohl is working with the BAH to construct an acceptable pad according to BAH rules so that surface water does not come into contact with compost pile material, and to implement better cover practices on the pile.

The facility has not reported its intent to pump and land apply manure to either Stevens County or the MPCA at least three days before pumping as required by the rules if the facility desires to be exempt from air quality requirements during this operation. The Nohl facility land applies manure by injection, which greatly attenuates air emissions from land application fields (Moseley et al 1998; Hanna et al 2000). Air impacts from fields are expected to be minimal.

4.7.5 Olson

The site is registered with the Stevens County Feedlot Program.

Because his facility is smaller than regulatory thresholds, Olson is not required to test manure or soil before applying the solid manure to his fields. Estimates of manure production indicate that Olson has adequate acreage to apply the manure according to recommended agronomic rates estimated using the University of Minnesota Extension Services published estimates. Olson reports maintaining setbacks from sensitive features. There is adequate manure application acreage for manure production at this facility. Manure from this facility is surface applied. Air emission impacts from surface application are expected to be minimal since this is a small facility that produces a relatively small volume of manure.
Site manure management data obtained from the farrowing and Olson operations indicate that these two facilities have in the past utilized a common field for land application of manure. This field is part of the Olson farm, and is located immediately south of the Olson feedlot site (see Figures 2-5 and 2-17). Available evidence indicates that this has not resulted in overapplication of manure because both have always been required to apply manure at agronomic rates. However, as required in Minn. R. 7020, if the farrowing site is to continue to use fields on Olson’s farm for manure application, the farrowing site must have the appropriate field and application information within their MMP, perform field and manure testing, and keep the appropriate land application records. Olson should also get a copy of the land application records for his files. For each cropping season, field owners (Olson in this case) should keep manure from different farms separate on land application fields as a best management practice and provide that information to the farrowing site for use in their MMP as required.

Olson’s partial confinement barns have open lots, but have not been evaluated for an Open Lot Agreement (OLA), which Olson has not requested. An assessment for an OLA is not required until October 1, 2005. However, MPCA’s initial observations concluded that the site does not appear to have a storm water impact problem due to the surface water runoff pattern that is directed toward an adjacent field and terminates there.

Minnesota requirements for feed storage areas and pest control were met.

During the November 2001 MPCA inspection, an inadequate amount of cover material was noted on the compost pile. During the October 2002 inspection, an inadequate amount of cover material was again noted on the compost pile and Olson was directed to increase the cover on the pile.

4.7.6 Paul

The site is registered with the Stevens County Feedlot Program. Paul obtained the appropriate approval from the Stevens County Feedlot Program before construction of the barn.

Review of the manure and soil testing records indicate that the requirements for record keeping for facilities with over 300 AU are met. Field location and application rate information was obtained and reviewed and nutrient application rates are in compliance with recommended agronomic rates based on expected crop yields. Paul reports maintaining setbacks from sensitive features. There is adequate manure application acreage for manure production at this facility.

Minnesota requirements for feed storage areas and pest control were met.

The sump drain from the perimeter tile drain around the manure pit was initially directed to drain into the wetland near the site. While not a compliance violation, this did pose a potential for a
manure discharge to surface water. The MPCA requested that Paul redirect drainage and discharge water from the sump to a vegetated buffer, and this has been completed.

During the November 2001 MPCA inspection, an inadequate amount of cover material was noted on the compost pile. The compost pile was located close to the wetland and in the path of surface water flow towards the wetland. Soon after the November 2001 inspection, Paul eliminated this compost pile and began to bury his animal mortality. During 2002, Paul began rendering his animal mortality. During the October 2002 MPCA inspection, no violations were observed regarding the site's animal mortality management practices.

The facility has not reported its intent to pump and land apply manure to either Stevens County or the MPCA at least three days before pumping as required by the rules if the facility desires to be exempt from air quality requirements during this operation. The Paul facility land applies manure by injection, which greatly attenuates air emissions from land application fields (Moseley et al 1998; Hanna et al 2000). Air impacts from fields are expected to be minimal.

4.7.7 Schaefer

The site is registered with the Stevens County Feedlot Program. Schaefer obtained the appropriate approval from the Stevens County Feedlot Program before construction of the barn.

Review of the manure and soil testing records indicates that Schaefer has some of the records required for record keeping for facilities exceeding 300 AU capacity. Since the new rules require that such records be kept, Schaefer has been advised of this requirement, and it is expected that he will comply with this requirement in the future. Field location and application rate information was obtained and reviewed and nutrient application rates (from the available records) are in compliance with recommended agronomic rates based on expected crop yields. Schaefer reports maintaining setbacks from sensitive features. There is adequate manure application acreage for manure production at this facility.

During the October 2002 MPCA inspection, the manure was observed being pumped from the pits. No violations were observed during the pit emptying procedures.

Minnesota requirements for manure and feed storage areas were met.

Animal burrows were observed near the concrete pits. MPCA representatives recommended that the burrows be filled.

Deterioration of the fill immediately adjacent to the concrete pits were observed during an MPCA inspection and the MPCA representative recommended filling the holes to improve drainage away from the pits. Those corrections have been made.
During the November 2001 MPCA inspection, an inadequate amount of cover material was noted on the compost pile. Animal burrows were observed near the compost site. During the October 2002 MPCA inspection, the compost pile did not seem to be working properly. The BAH was notified on both occasions. The BAH is currently working with Schaefer regarding operation of the compost pile.

The facility has not reported its intent to pump and land apply manure to either Stevens County or the MPCA at least three days before pumping as required by the rules if the facility desires to be exempt from air quality requirements during this operation. The Schaefer facility land applies most of its manure by injection, which greatly attenuates air emissions from land application fields (Moseley et al 1998; Hanna et al 2000). A small amount of manure from the older barns is intermittently surface applied. Air impacts from fields are expected to be minimal.

4.7.8 Solvie

The site is registered with the Pope County Feedlot Program. Solvie obtained the appropriate approval from the MPCA before construction of the barn.

Review of the manure and soil testing records indicates that Solvie has some of the records required for record keeping for facilities with over 300 AU. Since the new rules require record keeping, it is expected that Solvie will comply with this requirement in the future. MPCA followup to the inspection revealed that Solvie is now properly keeping land application records. Field location and application rate information was obtained and reviewed and nutrient application rates (from the available records) are in compliance with recommended agronomic rates based on expected crop yields. Solvie reports maintaining setbacks from sensitive features. There is adequate manure application acreage for manure production at this facility.

Manure storage structures consist of a concrete pit beneath the HPP barn and no violations were observed near that pit. The sidewalls of the pre-existing clay lagoon were noted to have trees and deep-rooted vegetation that were judged to be too close to the basin, potentially damaging the sidewalls. The MPCA representative recommended that a 5-foot perimeter be cleared of all trees and deep-rooted vegetation. Clean water diversions are also necessary to reduce the amount of clean water entering the basin. It appears that no discharges have occurred from the basin due to the above.

Minnesota requirements for feed storage areas and pest control were met.

During the November 2001 MPCA inspection, animal parts were observed in several locations and an inadequate amount of cover material was used at those locations. During the October 2002 MPCA inspection, the compost pile was consolidated and was judged to be functioning and
operated properly. HPP now reports that Solvie no longer composes, and uses rendering exclusively to manage mortalities.

The facility has not reported its intent to pump and land apply manure to either Pope County or the MPCA at least three days before pumping as required by the rules if the facility desires to be exempt from air quality requirements during this operation. The Solvie facility land applies most of its manure by injection, which greatly attenuates air emissions from land application fields (Moseley et al 1998; Hanna et al 2000). A small amount of manure from the older barn is surface applied with immediate incorporation. Air impacts from fields are expected to be minimal.

4.7.9 Spohr

The site is registered with the Stevens County Feedlot Program. Spohr obtained the appropriate approval from the Stevens County Feedlot Program before construction of the barn. Review of the manure and soil testing records indicate that the requirements for record keeping for facilities exceeding 300 AU capacity are met. Field location and application rate information was obtained and reviewed and nutrient application rates are in compliance with recommended agronomic rates based on expected crop yields. Spohr reports maintaining setbacks from sensitive features. There is adequate manure application acreage for manure production at this facility. Minnesota requirements for manure storage structures, feed storage areas, pest control, and surface water drainage were met. During the November 2001 and October 2002 MPCA inspections, the site was found to be operating its compost pile according to animal mortality management requirements.

The facility has not reported its intent to pump and land apply manure to either Stevens County or the MPCA at least three days before pumping as required by the rules if the facility desires to be exempt from air quality requirements during this operation. The Spohr facility land applies most of its manure by injection, which greatly attenuates air emissions from land application fields (Moseley et al 1998; Hanna et al 2000). A small amount of manure from the older barns is surface applied with immediate incorporation. Air impacts from fields are expected to be minimal.

4.7.10 Zeltwanger

The site is registered with the Stevens County Feedlot Program.

Zeltwanger is required to keep records of soil tests, manure loading rates, and field location rates, none of which were provided. Estimates of manure production indicate that Zeltwanger has adequate acreage to apply the manure according to recommended agronomic rates estimated using the University of Minnesota Extension Services published estimates. Zeltwanger reports
maintaining setbacks from sensitive features. There is adequate manure application acreage for manure production at this facility. Manure from this facility is surface applied. Air emission impacts from surface application are expected to be minimal since this small facility produces a relatively small volume of manure.

Minnesota requirements for manure storage structures, feed storage areas, pest control, and surface water drainage were met.

During the November 2001 and the October 2002 MPCA inspections no violations of animal mortality management regulations were observed. Zeltwanger reports that his mortalities are picked up for rendering.

4.7.11 Overall Compliance Issues

The HPP project was generally compliant with Minnesota requirements regarding feedlot operations and manure management practices. Although four of the sites did not have all of the required manure management records, the operators have been informed of this shortcoming and updated their records as applicable. Record keeping requirements are included in the revised feedlot rules, effective October 2000. All feedlot operators in the state must now comply with those requirements as appropriate.

4.8 Positive/Negative Effects of Project

4.8.1 Positive/Negative Effects of Project

The main benefits from the project are economic, largely to the HPP members, but also to the community.

The project was established in part to provide a stable supply of feeder pigs to the HPP members. This project will apparently provide that stable supply.

The project will produce additional jobs in the community, particularly at the farrowing/nursery facility. It will also provide additional opportunity for area businesses to provide products and services to the expanded operations.

The project may also allow the HPP members to better compete with hog producers outside of the HPP area. This project may also increase family income, owing to the expanded operation at many of the sites.

The Minnesota Department of Agriculture performed a modeling study (MDA 2002) of the economic impact of livestock processing plants in Minnesota. This study modeled combined
economic impacts (direct, indirect, and induced) on the state and local economies in the billions of dollars annually.

The construction of new, deep pit barns has allowed the use of certain older facilities to be eliminated or greatly reduced. The Spohr manure basin has been replaced with a deep pit barn. This greatly reduced air emissions from the Spohr site. This may also provide less opportunity for leakage to ground water from the manure storage facilities. The older barns on the Schaefer site are now used only intermittently as housing for cull animals. This has considerably reduced the generation and land application of solid manure from this site.

As noted in Section 2.2.3, manure has value as a soil amendment, adding nutrients and organic matter to soil. Soil structure and water retention capability are enhanced by appropriate manure application.

4.8.2 Negative Effects of Project

The project will increase the volume of manure generated in the area owing to the expansion of the number of hogs raised at many of the sites. If not managed in accordance with applicable setbacks and appropriate loading rates, adverse impacts to ground water and surface water could occur. At present, the applicants report and the rules require adherence to setbacks and appropriate application rates. Aside from the manure generated at the farrowing/nursery site, the manure generation at the finishing sites should be unaffected by obtaining the feeder pig supply from HPP as opposed to another supplier.

Certain sites have land application areas that are underlain by granular soils. Application in these areas increases the chance for impact to shallow ground water. The MPCA and the counties currently require that land application on granular soils be limited to spring/early summer application, thus reducing the potential for shallow ground water impact.

Computer modeling has indicated that all sites, with the exception of Olson and Zeltwanger, will have an increase in air emissions from the expanded facilities. The modeling indicates that at the farrowing/nursery and Schaefer sites, exceedance of applicable air quality standards may occur.

The project uses subtherapeutic dosage of pharmaceuticals. This is common in the industry. There is consensus in the scientific community that this industry-wide practice is contributing to the development of pathogen resistance to antibiotics, although the sites probably do not contribute significantly to this problem on an individual basis.

Feedlots collectively contribute significantly to greenhouse gas generation, but individual site contributions are insignificant.
4.8.3 Effects Potentially Requiring Mitigation

The predicted exceedance of the air quality standards at the farrowing/nursery site and the Schaefer site will require a review of alternatives to mitigate the anticipated emissions.

BAH reports that the facilities are in compliance with their rules, or are working to attain compliance, as the rules are enforced industry-wide. There is no mitigation proposed at this time.
5.0 MITIGATION MEASURES

5.1 SITE SPECIFIC MITIGATION MEASURES

In this section, each facility of the HPP project is reviewed to identify whether EIS findings in previous sections indicate the potential for significant environmental impacts. The results of this review will identify those conditions at each facility that may warrant assessment of mitigation alternatives to bring the facility into compliance or to protect against future violations. It is important to note that the discussion of predicted air quality violations and the associated mitigation needs are based on the computer modeling of each facility and not on data documenting an actual violation.

Minn.R. 7020.0300 subp. 23 defines a 300-foot buffer strip around wetlands and most intermittent streams and ditches as special protection areas. Minn. R. 7020.2225 subp. 6 places restrictions on manure application within special protection areas, including setbacks from the wetland, intermittent stream, or ditch and allowable phosphorus levels in the soil. All HPP operators must observe these requirements as appropriate, and they have reported that they do so.

5.1.1 Farrowing Facility

The farrowing/nursery facility is modeled to potentially violate the 5-day Minnesota ambient air quality standard (5-day standard) for hydrogen sulfide at the north and south property lines if the 21 ppb background concentration is included. The site also has the potential for off-site migration of annoying odors, based on the modeling results. The maximum hourly hydrogen sulfide concentration at the road right-of-way on the south side of the facility is modeled at 51.01 ppb. On the north property line the maximum hourly hydrogen sulfide concentration is modeled at 62.89 ppb. At both the north and south property lines the modeled concentrations with the 21 ppb background concentration are projected to exceed the 30-ppb standard more than twice within one or more 5-day periods.

The maximum tVOOC concentration at the north property line is 79.2 ug/m³, which is above the 70 ug/m³ threshold for annoying odors. However, by the time the odorous plume reaches the site’s nearest neighbor approximately 1400 feet west of the site, its intensity is reduced to a detectable but non-annoying concentration, according to the modeling.

The facility is also required to update its MPCA feedlot permit application. HPP has submitted an updated permit application, dated June 21, 2001, which is currently being reviewed by the MPCA.

HPP reports that appropriate setbacks are observed at the farrowing site related to land application of manure. The facility has submitted annual manure management reports to the
MPCA and keeps the necessary records as required by the rules and feedlot guidance. HPP reports that the volume of manure that has been land applied on an annual basis has ranged from 0.58 to 5.86 million gallons. The facility reports that it has approximately 1,561 acres available for land application, which appears to be adequate to handle the volume of manure generated.

The farrowing site uses land application fields with both cohesive and granular soils. HPP has agreed to restrict fall application of manure to cohesive soils only. Therefore, no additional mitigation is required for application on granular soils unless the farrowing facility elects to apply manure on granular soils in the fall.

The facility reportedly freezes animal mortalities for subsequent composting and burns dead piglets (and occasional sows) in an on-site incinerator. The incinerator is now in compliance with all requirements.

5.1.2 Charles

The Charles site has not been built, but, if built as modeled, is anticipated to be in compliance with the air quality requirements when operational, based on air modeling. The predicted maximum concentrations of hydrogen sulfide and ammonia do not exceed regulatory levels at the property line.

The rules require that Charles conform to the specific setbacks during land application of manure. The Charles site is in an area of cohesive soil, so limitations on fall application are not applicable. The Charles site includes approximately 1,183 acres of land anticipated to be available for land application, which appears to be adequate for the volume of manure anticipated.

Charles plans on managing mortalities through composting.

5.1.3 Greiner

The Greiner site is modeled to be in compliance with the air quality requirements. The maximum modeled concentrations of hydrogen sulfide and ammonia do not exceed the regulatory levels at the property line.

The facility is registered with Pope County as required. Greiner reports that setbacks are complied with during land application of manure. The records provided by Greiner report annual manure volumes that have ranged from 280,000 to 360,000 gallons. Greiner reports that there are approximately 448 acres of land available for land application, which appears to be adequate for the volume of manure generated. The fields Greiner reportedly applies manure to are cohesive in nature.
Greiner manages mortalities through a rendering service.

Mitigation at this site is not required.

5.1.4 Nohl

The Nohl site is modeled to be in compliance with the air quality requirements. The predicted maximum concentrations of hydrogen sulfide and at the property line exceed the 30 ppm limit, but not for a frequency that would cause a violation of the 5-day standard.

The facility is registered with Stevens County as required. Nohl reports that setbacks are complied with during land application of manure, and that manure is applied to granular soil only in the spring/early summer. There is a potential to impact ground water if fall application of manure occurs on granular soil fields, and mitigation might be required in this event.

The records provided by Nohl report annual manure volumes that have ranged from 144,000 to 526,000 gallons. Nohl reports that there are approximately 1032 acres of land available for land application, which appears to be adequate for the volume of manure generated.

Nohl manages mortalities through composting. Inspection of the composting site by MPCA has identified that there was an inadequate amount of bulking material used in the compost pile and the pile was not placed on an impermeable pad. The BAH has requested that Nohl perform his composting on a compacted clay pad, which Nohl reportedly plans install. Nohl is working with the BAH to meet their requirements.

5.1.5 Olson

The Olson site is modeled to be in compliance with the air quality requirements. The predicted maximum concentrations of hydrogen sulfide and ammonia do not exceed the regulatory levels at the property line.

The facility is registered with Stevens County as required. Olson reports that setbacks are complied with during land application of manure. Olson has not been required to keep records, due to his facility size, but reports from experience that annual manure volumes have ranged from 415-480 cubic yards. Olson reports that there are approximately 200 acres of land available for land application, which appears to be adequate for the volume of solid manure generated.

Manure management data obtained from the farrowing and Olson operations indicate that these two facilities have in the past utilized a common field for land application of manure. This field is part of the Olson farm, and is located immediately south of the Olson feedlot site (see Figures 2-5 and 2-17). Available evidence indicates that this has not resulted in overapplication of manure because both have always been required to apply manure at agronomic rates. As
required in Minn. R. 7020, if the farrowing site is to continue to use fields on Olson’s farm for manure application, the farrowing site must have the appropriate field and application information within their MMP, perform field and manure testing, and keep the appropriate land application records. Olson should also get a copy of the land application records for his files. For each cropping season, field owners (Olson in this case) should keep manure from different farms separate on land application fields as a best management practice and provide that information to the farrowing site for use in their MMP.

Olson manages mortalities through composting. Inspection of the composting site by BAH initially noted that there was an inadequate amount of bulking material used in the compost pile. The MPCA Compliance report indicates the compost pile is now operated correctly.

5.1.6 Paul

The Paul site is modeled to be in compliance with the air quality requirements. The predicted maximum concentrations of hydrogen sulfide and ammonia do not exceed the regulatory levels at the property line.

The facility is registered with Stevens County as required. Paul reports that setbacks are complied with during land application of manure. The records provided by Paul report annual manure volumes that have ranged from 120,000 to 290,000 gallons. Paul reports that there are approximately 630 acres of land available for land application, which appears to be adequate for the volume of manure generated.

The MPCA inspection in November 2001 observed that the compost pile did not comply with setback requirements from surface water, and that the compost pile was placed in the drainage pathway from a field into the wetland. At the time of the BAH inspection on May 6, 2002, there were no signs of a compost pile near the surface water. Paul indicated that the compost pile had been removed and that he resumed burying animal mortality in the area next to the machine shed. Paul informed the MPCA during the October 2002 inspection that he now renders his mortality.

The Paul site had a direct discharge from the perimeter time system around the barns to a drain tile that led directly to the wetland at the site. If leakage from the storage pits had occurred, direct pumping of impacted water or manure could have resulted. Paul has now moved the outlet to a vegetated buffer area.

5.1.7 Schaefer

The Schaefer site is modeled to potentially violate the 5-day standard for hydrogen sulfide and has the potential for off-site migration of annoying odors. The maximum hourly hydrogen
sulfide concentration (assuming a background concentration of 21 ppb) on the north property line is 31.31 ppb, and on the west property line it is 38.01 ppb for the current two-barn configuration (Table 4-49). The corresponding concentrations (with background) projected for the three-HPP finishing barn configuration are 35.21 ppb and 40.03 ppb, respectively (Table 4-51). Both the east and south property line concentrations (with background) are less than 30 ppb under both the two- and three-barn scenarios. For the two-barn configuration, only the west property boundary is projected to exceed the 30-ppb standard more than twice within any 5-day period. On the other hand, if the third HPP finishing barn is built, the 30-ppb standard is projected to be exceeded more than twice in any 5-day period along both the north and west property lines.

With the two-barn configuration, the maximum estimated tVOOC concentration is 83.55 ug/m$^3$ along the west property line. With an additional finishing barn, the estimated tVOOC concentration along the property line increases to 85.95 ug/m$^3$. Both of the projected concentrations exceed the 70ug/m$^3$ threshold representing annoying odors. Whether a third finishing barn is built or not, the maximum projected tVOOC concentration at the nearest neighbor, approximately 900 feet northwest of the barns, is less than the annoyance threshold of 70 ug/m$^3$.

The facility is registered with Stevens County as required. Schaefer reports that setbacks are complied with during land application of manure. The records provided by Schaefer report annual manure volumes that have ranged from 270,000 to 606,000 gallons. Schaefer reports that there are approximately 1,345 acres of land available for land application, which appears to be adequate for the volume of manure generated.

The easternmost land application fields used by Schaefer are located in an area of granular soil. If manure were to be applied on granular soils in the fall, there would be the potential to impact ground water. If Schaefer plans on applying manure in the fall to these fields, the threat to ground water would need to be addressed.

Schaefer manages mortalities through composting. The most recent BAH inspection did not observe active composting but noted that the pile location was acceptable. MPCA inspection noted that the compost pile did not appear to be operating correctly. The BAH has been notified and is working with Schaefer to improve the operation.

5.1.8 Solvie

The Solvie site is modeled to comply with the air quality requirements. The predicted maximum concentrations of hydrogen sulfide and ammonia do not exceed regulatory levels at the property line.
The facility is registered with Pope County as required. Solvie reports that setbacks are complied with during land application of manure. The records provided by Solvie report annual manure volumes that are approximately 900,000 gallons of manure, which includes direct precipitation into the storage basin. Solvie reports that there are approximately 1,040 acres of land available for land application, which appears to be adequate for the volume of manure generated. Some of the Solvie fields are granular in nature. If manure was applied on granular fields in the fall, there is the potential to impact ground water.

The MPCA inspection in November 2001 revealed a burial site with animal burrows evident and non-compliance with the animal disposal guidelines for burial (did not have three feet of cover). Solvie reports that he has buried mortalities in the past in different areas. This burial site has since been closed. Solvie composted at one time, but has reportedly ended this practice, and now uses rendering for mortality management.

5.1.9 Spohr

The Spohr site is modeled to comply with the air quality requirements. The predicted maximum concentrations of hydrogen sulfide and ammonia do not exceed the regulatory levels at the property line.

The facility is registered with Stevens County as required. Spohr reports that setbacks are complied with during land application of manure. The records provided by Spohr report annual manure volumes that have ranged from approximately 240,000 to 296,000 gallons of liquid manure and approximately 150 tons of manure/straw mixture. Spohr reports that there are approximately 1,000 acres of land available for land application, which appears to be adequate for the volume of manure generated.

None of the Spohr fields have granular soils.

Spohr manages mortalities through composting. Inspection of the composting site by BAH did not note any deficiencies with the composting operation.

5.1.10 Zeltwanger

The Zeltwanger site is modeled to be in compliance with the air quality requirements. The predicted maximum concentrations of hydrogen sulfide and ammonia do not exceed the regulatory levels at the property line.

The facility is registered with Stevens County as required. Zeltwanger reports that setbacks are complied with during land application of manure. Zeltwanger is required to keep records based to his facility size but has not provided any records for this report. Since the new rules require
record keeping, Zeltwanger is expected to comply with this requirement in the future. He notes that from experience that annual manure volume of 1,600 tons of manure/straw mixture. Zeltwanger reports that there are approximately 692 acres of land available for land application, which appears to be adequate for the volume of solid manure generated.

Zeltwanger reportedly manages mortalities through a rendering service.

5.2 Pending Regulations That Could Effect Operations or Compliance

There are no pending regulations or laws that would have an effect on the project or the assessment of compliance.

On December 16, 2002, the Environmental Protection Agency (EPA) announced final rules for regulating livestock waste runoff from agricultural feeding operations. The new rules may impact the HPP project in the future. In Minnesota, MPCA is the state NPDES permitting authority that implements the federal NPDES program. The revised feedlot rule (Minn. R. ch. 7020) is the primary rule governing feedlots in Minnesota. At present, MPCA is authorized to implement the NPDES program using the revised feedlot rule. Therefore, all feedlots with more than 1000 animal units are required to obtain an NPDES permit in Minnesota. The farrowing facility is the only HPP facility with more than 1000 AU at this time.

There are ongoing efforts on both the national and international level to address the issue of subtherapeutic use of pharmaceuticals in the animal agriculture industry and the migration of endocrine disruptors in the environment. There are no pending regulations at either the state or federal level that would affect the use of pharmaceuticals in the animal agriculture industry. There has been federal legislation proposed in the past that would restrict the use of pharmaceuticals. Future changes in the law regarding this issue could affect the use of pharmaceuticals at the farrowing/nursery and by the project members.

5.3 Mitigation Measures Recommended for Consideration

The EIS analysis has identified conditions at four facilities that require an assessment of mitigation measures or modifications to operating practices. The four sites that require consideration of mitigation are the farrowing/nursery site, and the Schaefer, Nohl and Solvie finishing sites.

The farrowing/nursery site and the Schaefer finishing site require a review of mitigation to deal with modeled violations of air quality standards at their compliance boundaries.

Some of the spreading fields used by the farrowing/nursery site and the Schaefer, Nohl and Solvie sites have granular soils. Land application of liquid manure on granular soils has the
potential to impact ground water in the area. The listed applicants will need to take steps to protect ground water if fall application on granular soil fields is to occur.

Mitigation Measures

The measures to be assessed to deal with anticipated air quality violations include the following, in no particular order:

- Engineering controls (e.g. reduction of pit storage surface area, biofilters, non-thermal plasma, and manure treatment.
- Contractual or regulatory mitigation (e.g. easements and/or variances);
- Institutional mitigation (e.g. right of way relocation and roadway closure);
- Operational changes (e.g. diet manipulation, pit additives, and temperature control);

The measures to protect shallow ground water from impact from fall application of manure on granular fields include:

- Operational changes (e.g. move fall application to cohesive fields or develop a manure management plan outlining how fall application will not threaten ground water).
6.0 MITIGATION ALTERNATIVES

As part of its Order resolving the EIS cost dispute, the Environmental Quality Board (EQB) mandated that a focused EIS document be prepared addressing the specific needs of this project. The EQB and MPCA Citizens Board also directed that the Generic Environmental Impact Statement on Animal Agriculture be used as a data source for the EIS analysis to the maximum extent possible, relying on other data sources only where necessary to fill data gaps. For these reasons, mitigation alternatives are described only for those issues identified in Section 5.0 as posing a potential for environmental impact from this project, and mitigation alternatives analyzed are largely those addressed in the GEIS. The issues for which mitigation alternatives are discussed include emissions emanating from pit barns, protection of ground water during manure application and management of animal mortalities.

6.1 METHODS FOR MITIGATING PIT BARN EMISSIONS

Two GEIS documents, Jacobson et al (1999) and Earth Tech (2001a), provided detailed descriptions of the mitigation and emission control technologies currently available or under development within the field of animal agriculture. These two resources are the primary sources for the following descriptions of the operational methods available for the mitigation of pit barn emissions. A summary of these mitigation alternatives is also provided in Table 6-1.

6.1.1 Biofilters

Agricultural air emissions are considered to be highly biodegradable (Earth Tech 2001a), and biofilters take advantage of this fact. Biofilters function by passing contaminated air through media that is laced with aerobic microorganisms, which generally are the ubiquitous environmental microflora rather than any specialized inoculum. The microorganisms transform the contaminants to carbon dioxide, waters, salts, and biomass (Jacobson et al 1999). The technology is simple in concept; it is known for example that injection of manure in cropland greatly reduces the odor and other problematic gases from manure land application (Hanna et al 2000; Lessard et al 1997; Goulding et al 1996; Moseley et al 1998), and the reason is that the soil is acting as a biofilter.

Feedlot biofiltration has been well known and viable in Europe since at least the 1960s, and has been attracting interest in this country as well (Leson and Winer 1991, Janni et al 1998, both cited in Jacobson et al 1991). It can be done relatively cheaply, as evidenced by the fact that Nicolai and Janni (1997, 1998) have built successful biofilters from wooden fence posts, shipping pallets, and compost and kidney bean straw for the media. The same workers
documented very high odor, hydrogen sulfide, and ammonia reduction rates in the biofilters they built and tested (Janni et al 1998; Nicolai and Janni 1998; Janni et al 1998).

Biofilters are relatively easy to operate and maintain. Media needs to be changed every several years, and must be kept moist, although Janni and Nicolai (1998) found that normal precipitation was sufficient for this purpose. Simple irrigation of the media can be employed if rainfall proves insufficient. Rodent and vegetation control is critical, in order to prevent channeling of airflow within the media. Spent media can be land applied, similar to manure.

Biofiltration is a proven odor control technology in industrial applications (Curran et al ND), as well as for fan ventilated livestock facilities (Jacobson et al 1999), and several such applications on curtain sided barns in Minnesota also appear to be working well (David Schmidt, UM Extension, personal communication). It appears to be a viable option in this case, particularly at the Hancock farrowing site, where the nursery barn, a fan ventilated building, appears to be the primary source of problematic emissions. Nicolai and Janni (1997) estimated the cost for a breeding, gestation, and farrowing facility at $0.28 per piglet.

6.1.2 Non-Thermal Plasma

Non-thermal plasma is a relatively new technology that is currently being researched by the University of Minnesota’s Biosystems and Agricultural Engineering Department (Jacobson et al 1999). Emission reductions are achieved by creating highly reactive chemical species that convert targeted compounds to non-toxic molecules. Ruan et al (1997; cited in Jacobson et al 1999) showed 100 percent removal of NH₃ and H₂S concentrations during laboratory testing that employed a packed bed plasma system to treat gaseous samples collected from swine farms. It would potentially have application to feedlot gases collected from deep pit barns. This control technology is, however, still in its formative stage, and additional research is needed to determine its efficiency and economic feasibility.

6.1.3 Aerobic Treatment

Aerobic treatment processes have been described in detail by Jacobson et al (1999). The science behind aerobic treatment is well understood and aerobic treatment of livestock waste has seen resurgence over the past several years. New technologies include low-rate aeration systems, aerobic treatment following solids separation, aerobic treatment following anaerobic treatment, and facultative treatment by means of shallow aeration of the liquid phase and deep anaerobic treatment of the settleable solids. The primary disincentive to aerobic treatment has been the high cost of supplying oxygen to the waste.

Aerobic treatment is typically applied to separated liquid manure or dilute effluents that have been moved from the collection pit to a lagoon or digester tank. Screening or mechanical mixing
may be required prior to aeration to deal with larger solids in the manure. Aeration creates a strong oxidizing environment in the waste, which decomposes the organic compounds associated with feedlot odor.

The fate of the nitrogen component of the slurry in an aerobic process is of particular importance. Nitrogen in livestock slurries is approximately equally divided between organic and inorganic (ammoniacal) nitrogen. The fate of nitrogen compounds during aeration is dependent on the treatment time, temperature and dissolved oxygen concentration (Svoboda, 1995; cited in Jacobson et al 1999). Ammoniacal nitrogen can be conserved or oxidized to nitrite and nitrate. Nitrate nitrogen in the treated slurry can be utilized as an oxygen source during storage, helping to prevent the development of anaerobic conditions in storage. There is a potential for the release of ammonia if the aeration level is not controlled properly, however.

The amount of oxygen required to oxidize organic matter in the manure can be determined from the biochemical oxygen demand (BOD). The minimum oxygen capacity should be twice the total daily BOD loading for complete oxidation of organic matter and also for converting ammonia to nitrate through the nitrification processes, with a hydraulic retention time of 10 days or more (NZAIE, 1984; cited in Jacobson et al 1999). Lower oxygen levels have been recommended as a lower cost alternative for partial odor control from livestock manure.

Biosolids will be produced during aerobic treatment, typically at a higher rate than would be typical for anaerobic treatment. These biosolids must be collected, transported, processed, stored, and utilized separately. There is a significant potential for odor production associated with the management of biosolids, although this may be minimized if the material is injected into soil.

Properly done, aerobic treatment is effective, and is currently in use on farms in the US. However, its use is not common due to relatively high capital and operating costs, and it can be labor intensive (Jacobson et al 1999). It typically requires that the manure be contained in a basin or container of some sort, within which the aeration process actually takes place. If a new container is needed for this purpose, this could be a significant infrastructure investment at the HPP facilities. If aeration could be performed in the existing manure pits, the cost may not be excessive, although a site specific evaluation would be required. An oxygenator for deep pits has been described by Gantzer et al (ND).

6.1.4 Anaerobic Treatment

Alone among the known feedlot air emission control methods, anaerobic treatment has the potential for recovery of some or all of the costs involved in treating the manure to reduce problematic emissions. In fact, properly designed and operated, anaerobic digestion may be a
profit center for the farming operation (CAEEDAC 1999). The process produces methane, which can be burned to produce electricity, hot water, and/or space heat for use on the farm or elsewhere. Chynoweth et al (1998) reviewed the use of anaerobic digestion worldwide.

Anaerobic treatment can be performed in an open air “anaerobic lagoon,” which is simply a lined basin that is managed to maintain low oxygen conditions in the water column. Such an application is not a good fit for the Hancock project, due in part to the need for very large basins, to which the manure would have to be moved to make the process work properly. Additionally, cold weather greatly limits the anaerobic activity; there is no control over environmental conditions; most of the nitrogen is lost to the atmosphere as ammonia; and, only very careful and daily management can prevent process imbalances that can cause significant odor release (Jacobson et al 1999). A successful anaerobic lagoon application (with biogas collection) at a 4000-sow farrow-to-wean facility in North Carolina has been described by Saele (ND), who indicates that such facilities may have the best chances for success in the southern US, where mild winter temperatures permit anaerobic digestion year round (see also Kramer 2002).

A more favorable anaerobic application at HPP facilities would involve contained treatment in a reactor vessel, rather than an open basin. Such anaerobic treatment has seen extensive development in Europe and especially in Germany, primarily due to favorable laws guaranteeing fixed rates for the electricity generated by utilization of the methane produced by the process (in 2002 there were 1650 farm-scale anaerobic digester installations in Germany alone, according to Kramer (2002)). One of the advantages of anaerobic treatment is that the nitrogen in the spent digestate is mainly in the form of ammonia, and therefore, directly available for plant uptake. All of the phosphorus would also remain in the digestate, since it is not volatile. Weed seeds and some pathogens are destroyed by the process, and vermin are not attracted to the digested waste (Jacobson et al 1999).

According to Krieg & Fischer Ingenieure GmbH (www.kriegfischer.de), there are numerous anaerobic biogas plants currently in operation in Germany, most of them agricultural, farm-scale plants. There are also several large-scale, centralized facilities in Denmark serving most of the livestock farms within a 6-mile radius (Jacobson et al 1999). At the time that the GEIS Literature Summary was prepared, there were reported to be 28 digesters operating in the US and 10 more under construction or planning. There were at that time no operating digesters in Minnesota.

Development since then has been rapid. A very successful digester has been installed and is now operating at a dairy in Isanti County (Nelson and Lamb 2000), and another has just been constructed at a dairy in Nicollet County. Kramer (2002) lists three midwestern US feedlot anaerobic digesters under construction, eight in startup, and six in operation, at the time of publication. Of these, one is a 2800 head swine finishing operation in startup, one is a 8300-head
swine finishing facility in full operation, and one is a 5000 sow gestation-farrow facility, also in full operation. The others listed by Kramer are dairies. Many more digesters are in use nationwide (USEPA ND).

A typical farm-scale anaerobic digester/biogas system would consist of a sump to collect and transfer manure, an insulated, gas-tight steel or concrete digester tank, a container or outdoor basin to collect and store the spent digestate, and accessory equipment to collect and process the gases generated in the digester for the production of electricity and heat. At the Isanti County dairy, the product gas is burned in a diesel engine, which powers a generator for electricity production and also produces hot water and space heat for the facility. The digestate must be land applied, but its odor is greatly reduced while retaining most of the nutrient properties (Nelson and Lamb 2000).

There is now a significant number of feedlot anaerobic digesters in operation nationwide, and many of them were partially funded by the USEPA AgSTAR program, a federal program developed to encourage livestock producers to include methane recovery in their site management (Saele ND; USEPA ND).

Feedlot anaerobic digestion has not been a success everywhere it has been tried, but this may relate more to poor design and/or management than inherent flaws in the process (Jacobson et al 1999; Rozdilsky 1998). The best chances for success would involve good design, construction, and management (as evidenced by the success in Isanti County), deployment at a relatively large feedlot (Parsons 1984; cited in Jacobson et al 1999 recommends use at a 400-hog or larger facility), and management by a trained operator, who could be the feedlot manager, as is the case at the Isanti County dairy. The equipment is relatively complex and the initial investment is relatively high. The Isanti County unit was built with federal funding assistance. A significant digester consulting, design, and construction industry is now in existence, and Kramer (2002) has tabulated many firms who specialize in this area, as well as sources of funding and technical assistance to help get a project underway.

Anaerobic digestion in a reactor vessel would pose a significant infrastructure investment at the HPP sites. However, it is undeniably effective, and, if properly conceived and designed, also poses considerable cost recovery potential.

6.1.5 Easement

Minnesota Statutes, Chapter 116.0713 Livestock Odor identifies that “State ambient air quality standards are applicable at the property boundary of a farm or a parcel of agricultural land on which a livestock production facility is located, except that if the owner or operator of the farm or parcel obtains an air quality easement from the owner of land adjoining the farm or parcel, the
air quality standards must be applicable at the property boundary of the adjoining land to which the easement pertains. The air quality easement must be for no more than five years, must be in writing, and must be available upon request by the agency or the county feedlot officer. Notwithstanding the provisions of this paragraph, state ambient air quality standards are applicable at locations to which the general public has access.”

In general, this means that a feedlot operator whose facility is found to cause actual or potential exceedances or violations of air quality standards may mitigate the problem, not by reducing or treating emissions, but by moving the compliance boundary farther away from the emission source by means of odor easements, if the adjoining landowner(s) agree.

6.1.6 Variance

Minnesota Statutes Chapter 116.07, Subdivision 5, allows that “The pollution control agency may grant variances from its rules as provided in Section 14.05, subdivision 4, in order to avoid undue hardship and to promote the effective and reasonable application and enforcement of laws, rules, and standards for prevention, abatement, or control of water, air, noise and land pollution, adopted pursuant to said administrative powers and under the provisions of this chapter.” As outlined in Minn. Stat. 14.055, subd. 2, the agency may attach any conditions to the variance that it determines are needed to protect public health, safety, or the environment and those conditions are then considered an enforceable part of the rule to which the variance applies. This would not reduce the emissions, but would instead resolve the potential exceedances by eliminating the applicability of air quality requirements to the facility.

6.1.7 Right-of-Way Relocation

The relocation of rights-of-way is fairly common in the hard rock and aggregate mining industries where roads (and even cities) have been moved so that the material beneath them can be mined. This action has not, to MPCA’s knowledge, been utilized in Minnesota as mitigation for an air quality standards violation, presumably due to the cost and the availability of alternative means for mitigation. This is an issue in this case because the road adjoining the farrowing site on the south is a “location to which the public has access” within the meaning of Minn. Stat. 116, meaning that air quality standards must be enforced there. This road could be relocated to the south as a means of moving the compliance boundary away from the emission source. This would resolve the issue, not by reducing emissions, but by moving the compliance boundary farther from the source.

6.1.8 Diet Manipulation

While “…several researchers believe that our ability to modify livestock diets to significantly reduce odors is a promising mitigation measure…,” “…significantly more research is required to
identify practical, cost effective dietary changes for each species” (Jacobson et al, 1999). Published research on this subject is limited. Most published research results have focused on dietary modification to reduce ammonia emissions, with only a few studies attempting to determine the effects of diet modification on odor or other feedlot emissions. Since the modeled violations identified in this EIS analysis involve, not ammonia, but hydrogen sulfide, there is little indication that this mitigation method is a good fit for this project.

Livestock diets have been manipulated by means of feed additives, changes in feeding management practices, selective feed ingredient use, enhanced precision in diet formulation, and dietary electrolyte balance. The results have been mixed, inconsistent, and/or not replicable. In some cases, various percentage reductions in various emission gases have been documented. In others, no changes have been observed, and in some, emissions actually increased. Some diet manipulation experiments resulted in decreased production of one or more pollutant parameters but simultaneous increases in others (see Jacobson et al, 1999; Earth Tech 2001a).

Research in this area appears to be in an early stage of development. While a variety of chemical additives and practices have been tried, and some show some promise, none have yet been shown to consistently and reliably reduce feedlot air emissions in the field on a continuing, cost effective basis. Results have often been reported as percentage decreases or increases, but the reported ranges are sometimes quite wide; Sutton et al (1999; cited in Earth Tech, 2001a) found that reduced-protein diets in hogs reduced ammonia production by 28-79%, for example. Not only is it not yet clear how a feedlot operator should employ diet manipulation to achieve results at the upper limit of this range on his particular feedlot, but knowledge of percentage reductions is only useful when it can be related to the mass of pollutants produced and the effects on air concentrations at the compliance boundary, and when it can be demonstrated that this percentage reduction can be reliably repeated in the field at reasonable convenience and cost. Further research may produce the answers to those questions.

### 6.1.9 Manure Pit Additives

Various chemical and biological additives have been introduced to manure pits to modify the biological and chemical activity in the pit in an effort to reduce emissions as well as to perform other functions such as facilitating breakdown of solids. Two additives are currently in use or have been proposed for use at the Hancock Pro Pork finishing facilities, Liqui-Blue™ and Barrier®. Information concerning these additives is provided in Section 2.1.1.2.

Manure pit additives generally fall under one of the following general categories: microbiological; masking; counteractants; adsorbents; absorbents; and chemical reactants. The following descriptions are taken from the Animal Agriculture GEIS Literature Review on Air Quality (Jacobson et al 1999).
* Microbiological additives generally are mixed cultures of enzymes or microorganisms designed to enhance the degradation of solids and reduce the volatilization of ammonia and/or hydrogen sulfide. These additives typically are intended to work either by metabolizing the odor causing material in manure, or by inhibiting odor causing biological processes by altering the enzyme structure in the manure.

* Masking agents cover one smell with another and are typically made from a mixture of compounds also having a strong, but less undesirable odor of their own. Generally speaking, masking agents can be effective for use as a short-term solution to an odor problem, but their viability as a long-term solution is limited by their degradability by the microorganisms present in manure. In addition, masking agents always increase the total odor level, and they do nothing to reduce the concentration of the contaminants in the emission, should those contaminants be present at concentrations exceeding the air quality standards.

* Counteractants do not react chemically with the malodor, but reduce the perceived odor level by eliminating the objectionable characteristics of the malodor. Counteractant chemicals neutralize the odors from phenols, amine, mercaptan, aldehydes, solvent odors, aromatics, and organic fatty acids. They usually lower or maintain the same odor level. Their effectiveness is not always predictable.

* Adsorbents and absorbents are biological or chemical materials that can collect odorous compounds on their surfaces (adsorb) or interiors (absorb). Examples are Sphagnum peat moss, sawdust, rice straw, sodium bentonite, and certain natural zeolites. Absorbents with a large surface area, such as sphagnum peat moss, have been found to reduce odor in some lagoons.

* Chemically-based additives act by chemically altering odorous compounds or enzymes and may also kill the bacteria that produce volatile organic compounds. Most chemical additives fall into one of four classifications. The four classifications and examples of each as identified by Jacobson et al (1999) are:

   • “Oxidizing Agents:” chlorine (as gas or sodium hypochlorite), potassium permanganate, and hydrogen peroxide will oxidize sulfides and inhibit sulfide production. Ozone has also been used as an oxidizing agent.

   • Precipitants: iron and zinc salts will react with sulfides to form insoluble compounds. Ferrous and ferric chloride have been used for that purpose. This keeps hydrogen sulfide out of the air by making the sulfide non-volatile.
• **pH Control:** sodium hydroxide or lime can be added to manure to raise the pH, inhibiting sulfide production and preventing hydrogen sulfide off-gassing, but probably increasing ammonia production.

• **Electron Acceptors:** electron acceptors are taken up preferentially to the sulfate ion, and thus prevent sulfide formation. Sodium nitrate can be used for this purpose.

Early researchers rarely found any of the pit additive products tested to be effective in predictably and reliably reducing odor levels in swine manure. While, more recently, some experimenters have documented significant reductions in odors in tests of various pit additives, it has also been found that success in the laboratory does not necessarily translate to success in the field. The microbiological additives, for example, generally require fairly narrow manure temperature, moisture and pH ranges and relatively high application frequencies in order to optimally perform. Easily controlled in the lab, these conditions may be hard to replicate and manage successfully under operational conditions on the farm. Further, “although there exist bacterial genera or species that can decompose odorous compounds like VFAs [volatile fatty acids] to reduce odor emission, little success has been reported in using these microbes as manure additives to control odor generation in the field” (Jacobson *et al.*, 1999).

In the case of manure additives, as with diet manipulation, there have been some promising results. However, this area of research is also still early in the process of developing practical application practices and technology for use in the field, and, so far, the reported percentage ranges for emission reductions have not been translated to reductions to acceptable levels at the compliance boundary.

The record regarding pit additives as practical feedlot emission controls is mixed at best. Despite the fact that some additives show potential, many others are considered of only marginal benefit in reducing feedlot odors (Earth Tech, 2001a).

### 6.1.10 Oil Sprinkling

Sprinkling of various types of vegetable oils inside animal buildings has been shown to effectively reduce airborne dust levels. The main thrust of research in this area has been concerned with occupational exposure to dust, rather than mitigation of dust emissions from feedlot buildings. However, a number of researchers such as Jacobson *et al.* (1998), noting that many odorous feedlot gases preferentially adhere to airborne dust particles, have evaluated whether lowering the dust generation by oil sprinkling would also reduce odor emissions from a pig nursery barn. However, this gave only mixed results. If oil sprinkling is employed, dust is generally prevented from ever becoming airborne, and therefore will probably not be capable of adsorbing the odorous gases, which themselves are airborne and therefore readily air-entrained.
and exhausted by the barn ventilation system. Concern also exists regarding worker safety due to slippery floors and the additional time needed to clean the pens between groups of pigs.

### 6.1.11 Reduction of Emitting Surfaces

According to Voermans et al (1996; cited in Earth tech, 2001a), the emitting surface is equal to the sum of the areas of the manure pit and the fouled surfaces of walls, solid floor, slats, and animals. Theoretically, reducing this total area should result in lowered emission rates of odorous gases. A mitigation method becoming popular in Europe is use of V-shaped gutters under the slats in pig housing facilities. The experiments by Voermans et al (1996) showed ammonia emission reductions between 43 and 70 percent were achieved by altering the dimensions of the storage lagoon to reduce the emitting surface. Reduction of emitting surface provides a simple method for new or expanding feedlots to make reductions in air emissions without excessive additional costs (Earth Tech, 2001a). There is no evidence to date on the reduction of hydrogen sulfide emissions by use of this method, nor is it known how much the emitting surface would have to be reduced in order to achieve regulatory compliance at the fenceline.

### 6.1.12 Temperature Control

Earth Tech (2001a) notes that summer ammonia emission rates from feedlots is higher than the winter rate, indicating that reducing manure temperature may reduce the rate in summer as well. Voermans et al (1996; cited in Earth tech, 2001a) documented ammonia emission reductions of up to 50 percent by lowering the temperature of the manure. The optimum temperature for maximum reduction is not clear, nor is it clear that this method is capable of reducing emissions to below concentrations of concerns, nor is a practical and reliable means to achieve it in the field; however, additional research in this area could provide the answers. Since the air emission issues at the HPP sites involve hydrogen sulfide and odorous gases rather than ammonia, this does not appear to be a good fit for this project.

### 6.1.13 Shelterbelts/ Windbreak Walls

Shelterbelts are rows of trees or other vegetation, historically placed for wind and snow protection. They also provide a visual barrier. According to Jacobson et al (1999), a few commentators have expressed the opinion that shelterbelts may have value in feedlot odor reduction, either by trapping dust and odorous gases, or by diluting odors through airflow disruption. There is little research actually documenting the efficacy of shelterbelts in odor control, however, and whatever beneficial effects they provide would not be available until the vegetation matures, at least 3-10 (or more) years. What research exists appears to cast some doubt on the ability of windbreaks to reliably control emissions at a significant level (James
Sullivan 2003, personal communication). More development work is needed to determine proper placement, size, vegetational makeup, and actual performance.

Windbreak walls may be built with various media typically covering a wood or steel frame. A variation of a windbreak wall used in North Dakota utilizes a frame constructed of wood and “chicken wire” that is filled with straw. Typically, they are placed immediately downwind of the building exhaust fans, in order to interrupt the airflow away from the buildings. Their odor mitigation capabilities are based on limiting the movement of building dust away from the feedlot, either by trapping it in the wall media, or by reducing forward momentum of airflow, thus causing entrained dust to settle out of the airflow. This relies on the tendency, noted above, of feedlot gases to preferentially adhere to dust particles. Windbreak walls also force vertical dispersion (and thus dilution) of the exhausted plume. They are currently employed on 200 farms in Taiwan, and research is currently being conducted in this country to evaluate their effectiveness. So far, a number of factors have rendered a determination of their effectiveness difficult (Jacobson et al. 1999), and it is not clear to what extent they mitigate odor impacts.

6.2 MITIGATION OF OPERATIONAL ISSUES

6.2.1 Mitigation of Threat to Ground water from Fall Application of Liquid Manure on Granular Soils

There is a potential to impact shallow ground water beneath fields with granular soils if manure is applied in the fall (Pain 1994). This risk can be reduced or eliminated through one or more of the following:

- Restrict fall application to fields with cohesive soils.

- Prepare a manure management plan that illustrates how fall application of liquid manure will be conducted so as not pose a threat to shallow ground water.

6.2.2 Management of Animal Mortalities

Compost pile construction and operations at compost sites within the HPP project do not strictly comply with compost site requirements in the BAH animal mortality regulations. Construction of covered compost piles on impervious, weight bearing pads with roofs overhead, temperature monitoring and recording in daily logs, use of adequate bulking material over and under animal carcasses, and a written composting protocol at each site would be required to strictly comply with animal composting regulations. BAH does not usually require these things if inspections show, in the inspector’s judgement, that the compost pile is working correctly and does not pose obvious environmental impact potential. BAH may require them if in its judgement they are required to correct a problem at a given site.
BAH’s rules also provide for enforcement action and fines for repeated failure to come into compliance. However, BAH prefers to work with operators at problem sites to correct the problems, and performs follow up inspections to assure that compliance is being achieved. BAH’s regulatory program is almost entirely complaint driven; staff limitations prevent a routine inspection program.

Site specific inspections by a BAH personnel at compost sites within the HPP project indicate satisfactory compliance with BAH mortality management policies.

### 6.3 Mitigation of Social and Economic Impacts

In order to mitigate the socioeconomic impacts associated with new feedlot development and operation, the GEIS (Wright *et al* 2001) recommends that existing institutions with credibility in rural areas do the following:

1. Explore with producers, community leaders, and other stakeholders ways to expand livestock production that (1) demonstrate the connection between livestock production and community viability, (2) respect neighbors and their quality of life, and (3) protect and enhance the natural environment.

2. Initiate discussion groups, policy seminars, and conferences for producers, community leaders, policy makers, and other state and local stakeholders, where the many issues of livestock expansion can be discussed and mutually acceptable alternatives developed.

3. Institute improved responsiveness, local presence, and better coordination among state agencies at the most local level through state initiatives and increased funding for staff activities.

4. Develop more programs to assist small and mid-sized producers who are not using confinement animal production systems to fulfill environmental stewardship responsibilities.

5. Working with producers, establish and promote marketing alternatives for small-sized producers and those not engaged in contract production.

6. Initiate a comprehensive examination of the meat and poultry procession industries in Minnesota, identifying the connections [among] production, processing, and social and community impacts.
Of the mitigation measures summarized above, only certain measures would address the issues at a specific site. A listing of those measures or technologies that are applicable for each site is provided below. In addition, the Nohl, Olson and Solvie facilities had noted deficiencies with their animal mortality practices. The deficiencies are judged to be minor in nature and should be easy to correct. In addition, the facilities that pump liquid manure have not been notifying the County or State of their pumping schedule as required to take advantage of the air quality exception during pumping and land application. They are not required by law to do this, but must do so if they want to take advantage of the pumping exemption in the law. This, again, can easily be corrected by making minor changes to operating practices, if they choose to do so.

6.4.1 Farrowing Facility

To address the pit barn emissions, the following technologies or measures are appropriate for consideration, in no particular order:

- Air Filtration/Biofilters
- Aerobic Treatment
- Anaerobic digestion in a reactor vessel
- Variance
- Right of Way Relocation

Other air emission control methods may be considered on a case-by-case basis, but would require more of a demonstration of potential for success than has been found to date in the literature or documented field experience. Data on empirical chemistry or biological action, parameters controlled, successful trials at field scale, convenience and ease of application, lack of unwanted side effects, and potential to achieve compliance with prescribed thresholds would all need to be included in the evaluation. Selection of a variance or road relocation may in addition require that the farrowing facility obtain an odor easement or additional land from nearby landowners.

To address the potential threat to ground water from fall application on granular soil, the following may be considered:

- Apply manure only in the spring on granular soil.

- Prepare a Manure Management Plan for MPCA approval that describes procedures that will protect ground water during fall application on granular soil.
6.4.2 Alan Charles Finishing Facility

No mitigation is required at this facility.

6.4.3 Gary Greiner Finishing Facility

No mitigation is required at this facility.

6.4.4 John Nohl Finishing Facility

To address the potential threat to groundwater from fall application on granular soil, the following should be considered:

- Apply manure only in the spring on granular soil.
- Prepare a Manure Management Plan for MPCA approval that describes procedures that will protect groundwater during fall application on granular soil.

6.4.5 Mike Olson Finishing Facility

No mitigation is required at this facility, except that to address the field overlap issue, the HPP farrowing site (and any other source of manure applied to Olson’s land) must show in its Manure Management Plan how manure applied on his land that originates from other feedlots will be managed to eliminate the potential for groundwater impacts (see Section 6.4.1).

6.4.6 David Paul Finishing Facility

No mitigation is required at this facility.

6.4.7 Stanley Schaefer Finishing Facility

The following technologies or measures appear to be appropriate for consideration to address the pit barn emissions:

- Air Filtration/Biofilters
- Aerobic Treatment
- Anaerobic digestion in a reactor vessel
- Easement
- Variance

Other air emission control methods may be considered on a case-by-case basis, but would require more of a demonstration of potential for success than has been found to date in the literature or documented field experience. Data on empirical chemistry or biological action,
parameters controlled, successful trials at field scale, convenience and ease of application, and potential to achieve compliance with prescribed thresholds would all need to be included.

To address the potential threat to ground water from fall application on granular soil, the following should be considered:

- Apply manure only in the spring on granular soil.
- Prepare a Manure Management Plan for MPCA approval that describes procedures that will protect ground water during fall application on granular soil.

6.4.8 Jere Solvie Finishing Facility

If in the future Solvie elects to land apply manure on granular soils, to address the potential threat to ground water from fall application on granular soil, the following should be considered:

- Apply manure only in the spring on granular soil.
- Prepare a Manure Management Plan for MPCA approval that describes procedures that will protect ground water during fall application on granular soil.

6.4.9 Wayne Spohr Finishing Facility

No mitigation is required at this facility.

6.4.10 John Zeltwanger Finishing Facility

No mitigation is required at this facility.

6.4.11 Permit conditions

Sections 6.1-6.4 analyze the available and feasible potential permit conditions applicable to the HPP sites. Upon the conclusion of the environmental review process, the appropriate regulatory authorities will develop specific mitigation methods to be employed where they are needed. These will be chosen from the list above.
7.0 ALTERNATIVES ANALYSIS

7.1 NO-BUILD

The No-Build scenario assumes that the HPP project is not built and that none of the HPP members would expand their respective operations. Under this scenario, only Olson, Zeltwanger, Spohr, Schaefer, and Solvie would have hog operations in the area. Under this scenario there are no modeled air quality violations or discharge sumps leading to surface water bodies. There could be similar operational deficiencies related to animal mortalities, but, as discussed previously, these could be easily managed and corrected. There would be no need to assess or implement the mitigation measures noted in Section 6.0.

7.2 AS-BUILT WITHOUT MITIGATION

The As-Built scenario with no mitigation would consist of a ten-facility operation that has predicted air emissions above established standards at two of the ten sites. Only one site, the farrowing/nursery site, is predicted to violate air quality standards in areas of public access. These exceedances are predicted by modeling, not actually measured; it is not confirmed that emission exceedances actually exist, although the magnitude of the modeled exceedances would suggest that they do. With no mitigation, there is the potential that the public that uses the roadway south of the farrowing facility could experience odors and hydrogen sulfide concentrations above levels of concern. In addition, the Schaefer neighbor to the west could also experience exposure to air emissions above levels of concern when near the Schaefer barns.

7.3 MITIGATED AS-BUILT

The EIS analysis has identified conditions at four facilities that require an assessment of mitigation measures or modification to operating practices. The four sites that require consideration of mitigation are the farrowing/nursery site, and the Nohl, Schaefer and Solvie finishing sites. The farrowing/nursery site and the Schaefer finishing site require a review of mitigation to deal with predicted exceedances of air quality standards at their compliance boundaries. The farrowing/nursery site, and the Schaefer, Nohl and Solvie finishing sites need to address the risk to ground water from fall application of manure on granular soil fields if they choose to use those fields for fall application.

The measures to be considered to deal with predicted air emission exceedances include the following:

• Engineering controls (biofilters, air filtration, aerobic treatment, anaerobic digestion in a reactor vessel);
• Contractual or regulatory mitigation (easements and/or variances);
• Institutional mitigation (right of way relocation and roadway closure);

The measure to deal with the potential to impact ground water from fall application of liquid manure on fields underlain with granular soil includes:

• Operational changes (commit to fall application of liquid manure on only cohesive soil, or prepare a Manure Management Plan for fall application on granular soil).

7.3.1 Farrowing Facility

A group of alternatives appear to be feasible and likely effective in reducing the predicted emissions from the barns at the site. The modeling suggests that the majority of emissions emanate from the nursery barn and the mitigation measures would accordingly need to be focused on that barn. The list of alternatives is discussed below.

• Engineering controls (windbreak walls, biofilters, non-thermal plasma, aerobic treatment, and anaerobic digestion in a reactor vessel).

HPP could implement engineering controls at the facility to reduce the emissions generated, treat or disperse the emissions, or treat the manure. Treatment of emissions through biofilters is a viable method of achieving the needed reduction in emissions from the site. Technology such as non-thermal plasma and anaerobic treatment would likely require significant change to the existing structures and capital expenditures to install and operate the equipment. As noted above, anaerobic digestion may allow some cost recovery, and there may be government funding assistance available. Aerobic treatment may not require significant infrastructure changes if an approach similar to that described by Gantzer Environmental et al (ND) is used.

• Contractual or regulatory mitigation (easements and/or variances);

HPP could petition the MPCA for issuance of a variance from the applicable air quality standards. If approved, this would address the issue by modifying standards applicable to this site.

• Obtain easements at property boundaries; and
• Institutional mitigation (right of way relocation and roadway closure).

HPP could petition Stevens and Swift Counties to either relocate the roadway leading past the site farther to the south or close the roadway in front of the facility and turn it into a private access road. HPP would also likely need to purchase sufficient property to move the compliance
point a sufficient distance south of the roadway, or obtain an easement for the purpose from the current property owner.

To address the threat to ground water from fall application of liquid manure to granular soil fields, the farrowing/nursery site could either commit to conduct fall application only on fields comprised of cohesive soil, or rewrite its Manure Management Plan for MPCA approval that would outline procedures for fall application on granular soil fields that would not threaten ground water.

### 7.3.2 Stanley Schaefer Finishing Facility

A group of alternatives appear to be feasible and likely effective in reducing the predicted emissions from the barns at the site. The modeling suggests that the predicted violation of standards is due to barn proximity to the property line. Mitigation measures would thus likely need to be focused on all three barns at the site, although they may not be required at all of the barns to achieve the needed reduction in emissions. The list of alternatives is discussed below.

- **Engineering controls (windbreak walls, biofilters, non-thermal plasma, aerobic treatment, and anaerobic digestion in a reactor vessel).**

  Schaefer could implement engineering controls at the facility to reduce the emissions generated, treat or disperse the emissions, or treat the manure. Treatment of emissions through biofilters is a viable method of achieving the needed reduction in emissions from the site. Technology such as non-thermal plasma and anaerobic treatment would likely require significant change to the existing structures and capital expenditures to install and operate the equipment. As noted above, anaerobic digestion may allow some cost recovery, and there may be government funding assistance available. Aerobic treatment may not require significant infrastructure changes if an approach similar to that described by Gantzer Environmental et al (1995) is used.

- **Contractual or regulatory mitigation (easements and/or variances);**

  Schaefer could attempt to obtain an easement from the adjacent property owner. If obtained, this would address the issue by obtaining contractual approval for the emissions to migrate onto private property.

To address the threat to ground water from fall application of liquid manure to granular soil fields, Schaefer could either commit to conduct fall application only on fields comprised of cohesive soil or prepare a Manure Management Plan for MPCA approval that would outline procedures for fall application on granular soil fields that will not threaten ground water.
7.3.3 **John Nohl Finishing Facility**

Some of the fields used by Nohl for manure application have granular soils. To address the threat to ground water from fall application of liquid manure to granular soil fields, Nohl could either commit to conduct fall application only on fields comprised of cohesive soil, or prepare a Manure Management Plan for MPCA approval that would outline procedures for fall application on granular fields that will not threaten ground water.

7.3.4 **Jere Solvie Finishing Facility**

Some of the fields used by Solvie for manure application have granular soils. While Solvie reports that he does not currently apply to granular soils, he may elect to do so at some future point. In this event, to address the threat to ground water from fall application of liquid manure to granular soil fields, Solvie could either commit to conduct fall application only on fields comprised of cohesive soil, or update his Manure Management Plan for MPCA approval to outline procedures for fall application on granular fields that will not threaten ground water.
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### Hancock Pro Pork EIS Tables List

<table>
<thead>
<tr>
<th>Table #</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1</td>
<td>HPP Shareholders</td>
</tr>
<tr>
<td>1-2</td>
<td>HPP Project Chronology</td>
</tr>
<tr>
<td>2-1</td>
<td>Feedlot General Summaries</td>
</tr>
<tr>
<td>2-2</td>
<td>Feed Additive Descriptions</td>
</tr>
<tr>
<td>2-3</td>
<td>Pit Additives</td>
</tr>
<tr>
<td>2-4</td>
<td>Facility Barn and Manure Storage Summaries</td>
</tr>
<tr>
<td>2-5</td>
<td>Facility Manure Land Application Practices</td>
</tr>
<tr>
<td>2-6</td>
<td>Mortality Management Practices</td>
</tr>
<tr>
<td>2-7</td>
<td>Certificate of ComplianceProvisions</td>
</tr>
<tr>
<td>2-8</td>
<td>Animal Mortality Management State Requirements</td>
</tr>
<tr>
<td>3-1</td>
<td>Aquifer Characteristics Beneath HPP Project Area</td>
</tr>
<tr>
<td>3-2</td>
<td>Rare and Endangered Species within Project Area</td>
</tr>
<tr>
<td>3-3</td>
<td>Stevens County Population Profile</td>
</tr>
<tr>
<td>3-4</td>
<td>Pope County Population Profile</td>
</tr>
<tr>
<td>3-5</td>
<td>Number of Households in Area</td>
</tr>
<tr>
<td>3-6</td>
<td>Population in Localized Area</td>
</tr>
<tr>
<td>3-7</td>
<td>Farms in Minnesota</td>
</tr>
<tr>
<td>3-8</td>
<td>Pathogens of Concern</td>
</tr>
<tr>
<td>3-9</td>
<td>Wells Within 1/2 Mile of Facilities</td>
</tr>
<tr>
<td>3-10</td>
<td>Site Specific Environmental Setting Summary</td>
</tr>
<tr>
<td>4-1</td>
<td>Atmospheric gas concentrations used as the thresholds for adverse environmental impacts (20°C)</td>
</tr>
<tr>
<td>4-2</td>
<td>Compounds that define the tVOOC for the Hancock Pro Pork EIS</td>
</tr>
<tr>
<td>4-3</td>
<td>Monthly ammonia emission scalars for hog finishing barns</td>
</tr>
<tr>
<td>4-4</td>
<td>Background concentrations used in air quality modeling (20°C)</td>
</tr>
<tr>
<td>4-5</td>
<td>Dimensions and capacities of the farrowing site barns</td>
</tr>
<tr>
<td>4-6</td>
<td>Emission Rates for the farrowing site barns</td>
</tr>
<tr>
<td>4-7</td>
<td>Maximum hourly property-line and nearest-neighbor hydrogen sulfide concentrations for the farrowing site.</td>
</tr>
<tr>
<td>4-8</td>
<td>Maximum 13-week time-averaged property-line and nearest-neighbor hydrogen sulfide concentrations for the farrowing site.</td>
</tr>
<tr>
<td>4-9</td>
<td>Maximum hourly property-line and nearest-neighbor ammonia concentrations for the farrowing site.</td>
</tr>
<tr>
<td>4-10</td>
<td>Maximum 13-week time-averaged property-line and nearest-neighbor ammonia concentrations for the farrowing site.</td>
</tr>
<tr>
<td>4-11</td>
<td>Maximum hourly property-line and nearest-neighbor tVOOC concentrations for the farrowing site.</td>
</tr>
<tr>
<td>Table #</td>
<td>Title</td>
</tr>
<tr>
<td>---------</td>
<td>-------</td>
</tr>
<tr>
<td>4-12</td>
<td>Dimensions and capacities of the Charles finishing barn</td>
</tr>
<tr>
<td>4-13</td>
<td>Emission Rates for the Charles finishing barn</td>
</tr>
<tr>
<td>4-14</td>
<td>Maximum hourly property-line and nearest-neighbor hydrogen sulfide concentrations for the Charles site.</td>
</tr>
<tr>
<td>4-15</td>
<td>Maximum 13-week time-averaged property-line and nearest-neighbor hydrogen sulfide concentrations for the Charles site.</td>
</tr>
<tr>
<td>4-16</td>
<td>Maximum hourly property-line and nearest-neighbor ammonia concentrations for the Charles site.</td>
</tr>
<tr>
<td>4-17</td>
<td>Maximum 13-week time-averaged property-line and nearest-neighbor ammonia concentrations for the Charles site.</td>
</tr>
<tr>
<td>4-18</td>
<td>Maximum hourly property-line and nearest-neighbor tVOOC concentrations for the Charles site.</td>
</tr>
<tr>
<td>4-19</td>
<td>Dimensions and capacities of the Greiner finishing barn</td>
</tr>
<tr>
<td>4-20</td>
<td>Emission Rates for the Greiner finishing barn</td>
</tr>
<tr>
<td>4-21</td>
<td>Maximum hourly property-line and nearest-neighbor hydrogen sulfide concentrations for the Greiner site.</td>
</tr>
<tr>
<td>4-22</td>
<td>Maximum 13-week time-averaged property-line and nearest-neighbor hydrogen sulfide concentrations for the Greiner site.</td>
</tr>
<tr>
<td>4-23</td>
<td>Maximum hourly property-line and nearest-neighbor ammonia concentrations for the Greiner site.</td>
</tr>
<tr>
<td>4-24</td>
<td>Maximum 13-week time-averaged property-line and nearest-neighbor ammonia concentrations for the Greiner site.</td>
</tr>
<tr>
<td>4-25</td>
<td>Maximum hourly property-line and nearest-neighbor tVOOC concentrations for the Greiner site.</td>
</tr>
<tr>
<td>4-26</td>
<td>Dimensions and capacities of the Nohl finishing barns</td>
</tr>
<tr>
<td>4-27</td>
<td>Emission Rates for the Nohl finishing barns. The &quot;measured&quot; emission rates for the South Finishing Barn were assumed to be 95 percent of the North’s.</td>
</tr>
<tr>
<td>4-28</td>
<td>Maximum hourly property-line and nearest-neighbor hydrogen sulfide concentrations for the Nohl site.</td>
</tr>
<tr>
<td>4-29</td>
<td>Maximum 13-week time-averaged property-line and nearest-neighbor hydrogen sulfide concentrations for the Nohl site.</td>
</tr>
<tr>
<td>4-30</td>
<td>Maximum hourly property-line and nearest-neighbor ammonia concentrations for the Nohl site.</td>
</tr>
<tr>
<td>4-31</td>
<td>Maximum 13-week time-averaged property-line and nearest-neighbor ammonia concentrations for the Nohl site.</td>
</tr>
<tr>
<td>4-32</td>
<td>Maximum hourly property-line and nearest-neighbor tVOOC concentrations for the Nohl site.</td>
</tr>
<tr>
<td>Table #</td>
<td>Title</td>
</tr>
<tr>
<td>--------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>4-33</td>
<td>Dimensions and capacities of the Olson finishing barns</td>
</tr>
<tr>
<td>4-34</td>
<td>Emission Rates for the Olson finishing barns.</td>
</tr>
<tr>
<td>4-35</td>
<td>Maximum hourly property-line and nearest-neighbor hydrogen sulfide concentrations for the Olson site.</td>
</tr>
<tr>
<td>4-36</td>
<td>Maximum 13-week time-averaged property-line and nearest-neighbor hydrogen sulfide concentrations for the Olson site.</td>
</tr>
<tr>
<td>4-37</td>
<td>Maximum hourly property-line and nearest-neighbor ammonia concentrations for the Olson site.</td>
</tr>
<tr>
<td>4-38</td>
<td>Maximum annual property-line and nearest-neighbor ammonia concentrations for the Olson site.</td>
</tr>
<tr>
<td>4-39</td>
<td>Maximum hourly property-line and nearest-neighbor tVOOC concentrations for the Olson site.</td>
</tr>
<tr>
<td>4-40</td>
<td>Dimensions and capacities of the Paul finishing barns</td>
</tr>
<tr>
<td>4-41</td>
<td>Emission Rates for the Paul finishing barns.</td>
</tr>
<tr>
<td>4-42</td>
<td>Maximum hourly property-line and nearest-neighbor hydrogen sulfide concentrations for the Paul site.</td>
</tr>
<tr>
<td>4-43</td>
<td>Maximum 13-week time-averaged property-line and nearest-neighbor hydrogen sulfide concentrations for the Paul site.</td>
</tr>
<tr>
<td>4-44</td>
<td>Maximum hourly property-line and nearest-neighbor ammonia concentrations for the Paul site.</td>
</tr>
<tr>
<td>4-45</td>
<td>Maximum annual property-line and nearest-neighbor ammonia concentrations for the Paul site.</td>
</tr>
<tr>
<td>4-46</td>
<td>Maximum hourly property-line and nearest-neighbor tVOOC concentrations for the Paul site.</td>
</tr>
<tr>
<td>4-47</td>
<td>Dimensions and capacities of the Schaefer finishing barns</td>
</tr>
<tr>
<td>4-48</td>
<td>Emission Rates for the Schaefer finishing barns.</td>
</tr>
<tr>
<td>4-49</td>
<td>Maximum hourly property-line and nearest-neighbor hydrogen sulfide concentrations for the Schaefer site.</td>
</tr>
<tr>
<td>4-50</td>
<td>Maximum 13-week time-averaged property-line and nearest-neighbor hydrogen sulfide concentrations for the Schaefer site.</td>
</tr>
<tr>
<td>4-51</td>
<td>Maximum hourly property-line and nearest-neighbor ammonia concentrations for the Schaefer site after construction of the North, South, and Proposed Finishing Barns.</td>
</tr>
<tr>
<td>4-52</td>
<td>Maximum 13-week time-averaged property-line and nearest-neighbor hydrogen sulfide concentrations for the Schaefer site after construction of the North, South, and Proposed Finishing Barns.</td>
</tr>
<tr>
<td>4-53</td>
<td>Maximum hourly property-line and nearest-neighbor ammonia concentrations for the Schaefer site.</td>
</tr>
<tr>
<td>Table #</td>
<td>Title</td>
</tr>
<tr>
<td>---------</td>
<td>-------</td>
</tr>
<tr>
<td>4-54</td>
<td>Maximum hourly property-line and nearest-neighbor ammonia concentrations for the Schaefer site after construction of the North, South, Proposed Finishing Barns.</td>
</tr>
<tr>
<td>4-55</td>
<td>Maximum annual property-line and nearest-neighbor ammonia concentrations for the Schaefer site.</td>
</tr>
<tr>
<td>4-56</td>
<td>Maximum annual property-line and nearest-neighbor ammonia concentrations for the Schaefer site after construction of the North, South, and Proposed Finishing Barns.</td>
</tr>
<tr>
<td>4-57</td>
<td>Maximum hourly property-line and nearest-neighbor tVOOC concentrations for the Schaefer site.</td>
</tr>
<tr>
<td>4-58</td>
<td>Maximum hourly property-line and nearest-neighbor tVOOC concentrations for the Schaefer site after construction of the North, South, and Proposed Finishing Barns.</td>
</tr>
<tr>
<td>4-59</td>
<td>Dimensions and capacities of the Solvie finishing barns</td>
</tr>
<tr>
<td>4-60</td>
<td>Emission Rates for the Solvie finishing barns.</td>
</tr>
<tr>
<td>4-61</td>
<td>Maximum hourly property-line and nearest-neighbor hydrogen sulfide concentrations for the Solvie site.</td>
</tr>
<tr>
<td>4-62</td>
<td>Maximum 13-week time-averaged property-line and nearest-neighbor hydrogen sulfide concentrations for the Solvie site.</td>
</tr>
<tr>
<td>4-63</td>
<td>Maximum hourly property-line and nearest-neighbor ammonia concentrations for the Solvie site.</td>
</tr>
<tr>
<td>4-64</td>
<td>Maximum annual property-line and nearest-neighbor ammonia concentrations for the Solvie site.</td>
</tr>
<tr>
<td>4-65</td>
<td>Maximum hourly property-line and nearest-neighbor tVOOC concentrations for the Solvie site.</td>
</tr>
<tr>
<td>4-66</td>
<td>Dimensions and capacities of the Spohr finishing barns</td>
</tr>
<tr>
<td>4-67</td>
<td>Emission Rates for the Spohr finishing barns.</td>
</tr>
<tr>
<td>4-68</td>
<td>Maximum hourly property-line and nearest-neighbor hydrogen sulfide concentrations for the Spohr site.</td>
</tr>
<tr>
<td>4-69</td>
<td>Maximum 13-week time-averaged property-line and nearest-neighbor hydrogen sulfide concentrations for the Spohr site.</td>
</tr>
<tr>
<td>4-70</td>
<td>Maximum hourly property-line and nearest-neighbor ammonia concentrations for the Spohr site.</td>
</tr>
<tr>
<td>4-71</td>
<td>Maximum annual property-line and nearest-neighbor ammonia concentrations for the Spohr site.</td>
</tr>
<tr>
<td>4-72</td>
<td>Maximum hourly property-line and nearest-neighbor tVOOC concentrations for the Spohr site.</td>
</tr>
<tr>
<td>4-73</td>
<td>Dimensions and capacities of the Zeltwanger finishing barns</td>
</tr>
<tr>
<td>Table #</td>
<td>Title</td>
</tr>
<tr>
<td>---------</td>
<td>-------</td>
</tr>
<tr>
<td>4-74</td>
<td>Emission Rates for the Zeltwanger finishing barns.</td>
</tr>
<tr>
<td>4-75</td>
<td>Maximum hourly property-line and nearest-neighbor hydrogen sulfide concentrations for the Zeltwanger site.</td>
</tr>
<tr>
<td>4-76</td>
<td>Maximum 13-week time-averaged property-line and nearest-neighbor hydrogen sulfide concentrations for the Zeltwanger site.</td>
</tr>
<tr>
<td>4-77</td>
<td>Maximum hourly property-line and nearest-neighbor ammonia concentrations for the Zeltwanger site.</td>
</tr>
<tr>
<td>4-78</td>
<td>Maximum annual property-line and nearest-neighbor ammonia concentrations for the Zeltwanger site.</td>
</tr>
<tr>
<td>4-79</td>
<td>Maximum hourly property-line and nearest-neighbor tVOOC concentrations for the Zeltwanger site.</td>
</tr>
<tr>
<td>4-80</td>
<td>Summary of modeled air quality effects for post-project Hancock sites. A background hydrogen sulfide concentration of 21 ppb (v/v) is included in the evaluated property-line concentrations for the sites within 3 miles of the Hancock Pro Pork Farrowing Site (i.e. the farrowing, Nohl, Olson, and Schaefer sites). A background hydrogen sulfide concentration of 17 ppb (v/v) is included for sites beyond 3 miles of the farrowing site. A background concentration of 148 µg/m$^3$ is included in the evaluated property-line concentrations for all sites.</td>
</tr>
<tr>
<td>4-81</td>
<td>Comparison of measured atmospheric gas concentrations at 100-meters from a non-Hancock Pro-Pork swine manure storage basin to the American Conference of Governmental Industrial Hygienists (ACGIH) 8-hr threshold limit value (TVL), ACGIH 15-minute short-term exposure limit (STEL), California's Chronic Reference Exposure Levels, California's Acute Reference Exposure Levels and the Wisconsin Proposed 24-hour Ambient Air Standards.</td>
</tr>
<tr>
<td>4-82</td>
<td>Detailed Manure Management Review and Compliance Summary</td>
</tr>
<tr>
<td>4-83</td>
<td>Average Employment by Industry Sector, 1996</td>
</tr>
<tr>
<td>4-84</td>
<td>Minnesota Planning Forecasts</td>
</tr>
<tr>
<td>6-1</td>
<td>Summary of Mitigation Alternatives</td>
</tr>
</tbody>
</table>
### Hancock Pro Pork EIS Figures List

<table>
<thead>
<tr>
<th>Figure #</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1</td>
<td>Project Location</td>
</tr>
<tr>
<td>1-2</td>
<td>Project Location Map</td>
</tr>
<tr>
<td>2-1</td>
<td>Pre-Project Site Description</td>
</tr>
<tr>
<td>2-2</td>
<td>Regional Odor Sources</td>
</tr>
<tr>
<td>2-3</td>
<td>Pre-project Conditions Map Farrowing - Buildings</td>
</tr>
<tr>
<td>2-4</td>
<td>Project Site Conditions Map Farrowing - Buildings</td>
</tr>
<tr>
<td>2-5</td>
<td>Land Application Field Location Map - Farrowing Facility</td>
</tr>
<tr>
<td>2-6</td>
<td>Pre-project Conditions Map Charles - Buildings</td>
</tr>
<tr>
<td>2-7</td>
<td>Project Site Conditions Map Charles - Buildings</td>
</tr>
<tr>
<td>2-8</td>
<td>Land Application Field Location Map - Charles Facility</td>
</tr>
<tr>
<td>2-9</td>
<td>Pre-project Conditions Map Greiner - Buildings</td>
</tr>
<tr>
<td>2-10</td>
<td>Project Site Conditions Map Greiner - Buildings</td>
</tr>
<tr>
<td>2-11</td>
<td>Land Application Field Location Map - Greiner Facility</td>
</tr>
<tr>
<td>2-12</td>
<td>Pre-project Conditions Map Nohl - Buildings</td>
</tr>
<tr>
<td>2-13</td>
<td>Project Site Conditions Map Nohl - Buildings</td>
</tr>
<tr>
<td>2-14</td>
<td>Land Application Field Location Map - Nohl Facility</td>
</tr>
<tr>
<td>2-15</td>
<td>Pre-project Conditions Map Olson - Buildings</td>
</tr>
<tr>
<td>2-16</td>
<td>Project Site Conditions Map Olson - Buildings</td>
</tr>
<tr>
<td>2-17</td>
<td>Land Application Field Location Map - Olson Facility</td>
</tr>
<tr>
<td>2-18</td>
<td>Pre-project Conditions Map Paul - Buildings</td>
</tr>
<tr>
<td>2-19</td>
<td>Project Site Conditions Map Paul - Buildings</td>
</tr>
<tr>
<td>2-20</td>
<td>Land Application Field Location Map - Paul Facility</td>
</tr>
<tr>
<td>2-21</td>
<td>Pre-project Conditions Map Schaefer - Buildings</td>
</tr>
<tr>
<td>2-22</td>
<td>Project Site Conditions Map Schaefer - Buildings</td>
</tr>
<tr>
<td>2-23</td>
<td>Land Application Field Location Map - Schaefer Facility</td>
</tr>
<tr>
<td>2-24</td>
<td>Pre-project Conditions Map Solvie - Buildings</td>
</tr>
<tr>
<td>2-25</td>
<td>Project Site Conditions Map Solvie - Buildings</td>
</tr>
<tr>
<td>2-26</td>
<td>Land Application Field Location Map - Solvie Facility</td>
</tr>
<tr>
<td>2-27</td>
<td>Pre-project Conditions Map Spohr - Buildings</td>
</tr>
<tr>
<td>2-28</td>
<td>Project Site Conditions Map Spohr - Buildings</td>
</tr>
<tr>
<td>2-29</td>
<td>Land Application Field Location Map - Spohr Facility</td>
</tr>
<tr>
<td>2-30</td>
<td>Pre-project Conditions Map Zeltwanger - Buildings</td>
</tr>
<tr>
<td>2-31</td>
<td>Project Site Conditions Map Zeltwanger - Buildings</td>
</tr>
<tr>
<td>2-32</td>
<td>Land Application Field Location Map - Zeltwanger Facility</td>
</tr>
<tr>
<td>Figure #</td>
<td>Title</td>
</tr>
<tr>
<td>----------</td>
<td>-------</td>
</tr>
<tr>
<td>3-1</td>
<td>Regional Air Model Sources Pre- and Project Locations</td>
</tr>
<tr>
<td>3-2</td>
<td>Bedrock Geology</td>
</tr>
<tr>
<td>3-3 a &amp; b</td>
<td>Quaternary Geology</td>
</tr>
<tr>
<td>3-4 a, b &amp; c</td>
<td>Soil Group Trends</td>
</tr>
<tr>
<td>3-5 a-l</td>
<td>Regional Aquifers Extent, Top Elevation, Potentiometric Surfaces</td>
</tr>
<tr>
<td>3-6</td>
<td>High Q Wells - Quaternary Geology</td>
</tr>
<tr>
<td>3-7</td>
<td>Surface Water Resources</td>
</tr>
<tr>
<td>3-7a</td>
<td>Danvers Wetland</td>
</tr>
<tr>
<td>3-8 a-l</td>
<td>Surface Water Quality Data for nearby surface waters</td>
</tr>
<tr>
<td>3-9</td>
<td>Receptors within 1/2-mile of Land Application Areas - Farrowing Facility</td>
</tr>
<tr>
<td>3-10</td>
<td>Receptors within 1/2-mile of Land Application Areas - Charles</td>
</tr>
<tr>
<td>3-11</td>
<td>Receptors within 1/2-mile of Land Application Areas - Greiner</td>
</tr>
<tr>
<td>3-12</td>
<td>Receptors within 1/2-mile of Land Application Areas - Nohl</td>
</tr>
<tr>
<td>3-13</td>
<td>Receptors within 1/2-mile of Land Application Areas - Olson</td>
</tr>
<tr>
<td>3-14</td>
<td>Receptors within 1/2-mile of Land Application Areas - Paul</td>
</tr>
<tr>
<td>3-15</td>
<td>Receptors within 1/2-mile of Land Application Areas - Schaefer</td>
</tr>
<tr>
<td>3-16</td>
<td>Receptors within 1/2-mile of Land Application Areas - Solvie</td>
</tr>
<tr>
<td>3-17</td>
<td>Receptors within 1/2-mile of Land Application Areas - Spohr</td>
</tr>
<tr>
<td>3-18</td>
<td>Receptors within 1/2-mile of Land Application Areas - Zeltwanger</td>
</tr>
<tr>
<td>4-1</td>
<td>Odor Panel Responds to Total VOOC Concentration</td>
</tr>
<tr>
<td>4-2</td>
<td>Emissions Source Map for the Farrowing Site</td>
</tr>
<tr>
<td>4-3</td>
<td>Comparison of Monitoring and Modeling Results for the Farrowing Site</td>
</tr>
<tr>
<td>4-4</td>
<td>South Property-Line and CAM-Location Hydrogen Sulfide Concentrations for the Farrowing Site</td>
</tr>
<tr>
<td>4-5</td>
<td>Manure Pit Chemistry on Property-Line Hydrogen Sulfide Concentrations for the Farrowing Site</td>
</tr>
<tr>
<td>4-6</td>
<td>Maximum Property-Line and Nearest Neighbor Odor Intensities for the Farrowing Site</td>
</tr>
<tr>
<td>4-7</td>
<td>Farrowing Air Model Results - Project Hydrogen Sulfide (ppb v/v)</td>
</tr>
<tr>
<td>4-8</td>
<td>Farrowing Air Model Results - Project Ammonia (ug/m³)</td>
</tr>
<tr>
<td>4-9</td>
<td>Farrowing Air Model Results - Project Total Volatile Odorous Organics (ug/m³)</td>
</tr>
<tr>
<td>4-10</td>
<td>Source Map for the Proposed Charles Site</td>
</tr>
<tr>
<td>4-11</td>
<td>Manure Pit Chemistry on Property-Line Hydrogen Sulfide Concentrations for the Charles Site</td>
</tr>
<tr>
<td>4-12</td>
<td>Maximum Property-Line and Nearest Neighbor Odor Intensities for the Charles Site</td>
</tr>
<tr>
<td>Figure #</td>
<td>Title</td>
</tr>
<tr>
<td>----------</td>
<td>-----------------------------------------------------------------------</td>
</tr>
<tr>
<td>4-13</td>
<td>Charles Air Model Results - Project Hydrogen Sulfide (ppb v/v)</td>
</tr>
<tr>
<td>4-14</td>
<td>Charles Air Model Results - Project Ammonia (ug/m³)</td>
</tr>
<tr>
<td>4-15</td>
<td>Charles Air Model Results - Project Total Volatile Odorous Organics (ug/m³)</td>
</tr>
<tr>
<td>4-16</td>
<td>Emission Source Map for the Griener Site</td>
</tr>
<tr>
<td>4-17</td>
<td>Manure Pit Chemistry on Property-Line Hydrogen Sulfide Concentrations for the Griener Site</td>
</tr>
<tr>
<td>4-18</td>
<td>Maximum Property-Line and Nearest Neighbor Odor Intensities for the Griener Site</td>
</tr>
<tr>
<td>4-19</td>
<td>Greiner Air Model Results - Project Hydrogen Sulfide (ppb v/v)</td>
</tr>
<tr>
<td>4-20</td>
<td>Greiner Air Model Results - Project Ammonia (ug/m³)</td>
</tr>
<tr>
<td>4-21</td>
<td>Greiner Air Model Results - Project Total Volatile Odorous Organics (ug/m³)</td>
</tr>
<tr>
<td>4-22</td>
<td>Emission Source Map for the Nohl Site</td>
</tr>
<tr>
<td>4-23</td>
<td>Manure Pit Chemistry on Property-Line Hydrogen Sulfide Concentrations for the Nohl Site</td>
</tr>
<tr>
<td>4-24</td>
<td>Maximum Property-Line and Nearest Neighbor Odor Intensities for the Nohl Site</td>
</tr>
<tr>
<td>4-25</td>
<td>Nohl Air Model Results - Project Hydrogen Sulfide (ppb v/v)</td>
</tr>
<tr>
<td>4-26</td>
<td>Nohl Air Model Results - Project Ammonia (ug/m³)</td>
</tr>
<tr>
<td>4-27</td>
<td>Nohl Air Model Results - Project Total Volatile Odorous Organics (ug/m³)</td>
</tr>
<tr>
<td>4-28</td>
<td>Emission Source Map for the Olson Site</td>
</tr>
<tr>
<td>4-29</td>
<td>Manure Pit Chemistry on Property-Line Hydrogen Sulfide Concentrations for the Olson Site</td>
</tr>
<tr>
<td>4-30</td>
<td>Olson Air Model Results - Project H₂S (ppb/v)</td>
</tr>
<tr>
<td>4-31</td>
<td>Olson Air Model Results - Project Ammonia (ug/m³)</td>
</tr>
<tr>
<td>4-32</td>
<td>Olson Air Model Results - Project Total Volatile Odorous Organics (ug/m³)</td>
</tr>
<tr>
<td>4-33</td>
<td>Emission Source Map for the Paul Site</td>
</tr>
<tr>
<td>4-34</td>
<td>Manure Pit Chemistry on Property-Line Hydrogen Sulfide Concentrations for the Paul Site</td>
</tr>
<tr>
<td>4-35</td>
<td>Maximum Property-Line and Nearest Neighbor Odor Intensities for the Paul Site</td>
</tr>
<tr>
<td>4-36</td>
<td>Paul Air Model Results - Project Hydrogen Sulfide (ppb v/v)</td>
</tr>
<tr>
<td>4-37</td>
<td>Paul Air Model Results - Project Ammonia (ug/m³)</td>
</tr>
<tr>
<td>4-38</td>
<td>Paul Air Model Results - Project Total Volatile Odorous Organics</td>
</tr>
<tr>
<td>Figure #</td>
<td>Title</td>
</tr>
<tr>
<td>----------</td>
<td>-------</td>
</tr>
<tr>
<td>4-39</td>
<td>Emission Source Map for the Schaefer Site (No 3rd Barn)</td>
</tr>
<tr>
<td>4-40</td>
<td>Manure Pit Chemistry on Property-Line Hydrogen Sulfide Concentrations for the Schaefer Site</td>
</tr>
<tr>
<td>4-41</td>
<td>Maximum Property-Line and Nearest Neighbor Odor Intensities for the Schaefer Site</td>
</tr>
<tr>
<td>4-42</td>
<td>Schaefer Air Model Results - Pre-Project Hydrogen Sulfide (ppb v/v)</td>
</tr>
<tr>
<td>4-43</td>
<td>Schaefer Air Model Results - Pre-Project Ammonia (ug/m³)</td>
</tr>
<tr>
<td>4-44</td>
<td>Schaefer Air Model Results - Pre-Project Total Volatile Odorous Organics (ug/m³)</td>
</tr>
<tr>
<td>4-45</td>
<td>Schaefer Air Model Results - Project Hydrogen Sulfide (ppb v/v) (No 3rd Barn)</td>
</tr>
<tr>
<td>4-46</td>
<td>Schaefer Air Model Results - Project Ammonia (ug/m³) (No 3rd Barn)</td>
</tr>
<tr>
<td>4-47</td>
<td>Schaefer Air Model Results - Project Total Volatile Odorous Organics (ug/m³) (No 3rd Barn)</td>
</tr>
<tr>
<td>4-48</td>
<td>Schaefer Air Model Results - Project 3-Barn Hydrogen Sulfide (ppb v/v)</td>
</tr>
<tr>
<td>4-49</td>
<td>Schaefer Air Model Results - Project 3-Barn Ammonia (ug/m³)</td>
</tr>
<tr>
<td>4-50</td>
<td>Schaefer Air Model Results - Project 3-Barn Total Volatile Odorous Organics (ug/m³)</td>
</tr>
<tr>
<td>4-51</td>
<td>Emission Source Map for the Solvie Site</td>
</tr>
<tr>
<td>4-52</td>
<td>Noon-Hour Water Temperature for the Solvie Manure Basin</td>
</tr>
<tr>
<td>4-53</td>
<td>Noon-Hour Hydrogen Sulfide Flux Rates for the Solvie Manure Basin</td>
</tr>
<tr>
<td>4-54</td>
<td>Noon-Hour Ammonia Flux Rates for the Solvie Manure Basin</td>
</tr>
<tr>
<td>4-55</td>
<td>Noon-Hour tVOOC Flux Rates for the Solvie Manure Basin</td>
</tr>
<tr>
<td>4-56</td>
<td>Maximum Property-Line and Nearest Neighbor Odor Intensities for the Solvie Site</td>
</tr>
<tr>
<td>4-57</td>
<td>Solvie Air Model Results - Pre-Project Hydrogen Sulfide (ppb v/v)</td>
</tr>
<tr>
<td>4-58</td>
<td>Solvie Air Model Results - Pre-Project Ammonia (ug/m³)</td>
</tr>
<tr>
<td>4-59</td>
<td>Solvie Air Model Results - Pre-Project Total Volatile Odorous Organics (ug/m³)</td>
</tr>
<tr>
<td></td>
<td>Figure #</td>
</tr>
<tr>
<td>4-60</td>
<td>Solvie Air Model Results - Project Hydrogen Sulfide (ppb v/v)</td>
</tr>
<tr>
<td>4-61</td>
<td>Solvie Air Model Results - Project Ammonia (ug/m³)</td>
</tr>
<tr>
<td>4-62</td>
<td>Solvie Air Model Results - Project Total Volatile Odorous Organics (ug/m³)</td>
</tr>
<tr>
<td>4-63</td>
<td>Emission Source Map for the Spohr Site</td>
</tr>
<tr>
<td>4-64</td>
<td>Manure Pit Chemistry on Property-Line Hydrogen Sulfide Concentrations for the Spohr Site</td>
</tr>
<tr>
<td>Page</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td>4-65</td>
<td>Maximum Property-Line and Nearest Neighbor Odor Intensities for the Spohr Site</td>
</tr>
<tr>
<td>4-66</td>
<td>Spohr Air Model Results - Pre-Project Hydrogen Sulfide (ppb v/v)</td>
</tr>
<tr>
<td>4-67</td>
<td>Spohr Air Model Results - Pre-Project Ammonia (ug/m³)</td>
</tr>
<tr>
<td>4-68</td>
<td>Spohr Air Model Results - Pre-Project Total Volatile Odorous Organics (ug/m³)</td>
</tr>
<tr>
<td>4-69</td>
<td>Spohr Air Model Results - Project Hydrogen Sulfide (ppb v/v)</td>
</tr>
<tr>
<td>4-70</td>
<td>Spohr Air Model Results - Project Ammonia (ug/m³)</td>
</tr>
<tr>
<td>4-71</td>
<td>Spohr Air Model Results - Project Total Volatile Odorous Organics (ug/m³)</td>
</tr>
<tr>
<td>4-72</td>
<td>Emission Source Map for the Zeltwanger Site</td>
</tr>
<tr>
<td>4-73</td>
<td>Manure Pit Chemistry on Property-Line Hydrogen Sulfide Concentrations for the Zeltwanger Site</td>
</tr>
<tr>
<td>4-74</td>
<td>Zeltwanger Air Model Results - Project Hydrogen Sulfide (ppb v/v)</td>
</tr>
<tr>
<td>4-75</td>
<td>Zeltwanger Air Model Results - Project Ammonia (ug/m³)</td>
</tr>
<tr>
<td>4-76</td>
<td>Zeltwanger Air Model Results - Project Total Volatile Odorous Organics (ug/m³)</td>
</tr>
<tr>
<td>4-77</td>
<td>Regional Air Model Sources Pre- and Project Locations repeat of 3-1</td>
</tr>
<tr>
<td>4-78</td>
<td>Regional Air Mode Results Hydrogen Sulfide Pre-Project (ppb v/v)</td>
</tr>
<tr>
<td>4-79</td>
<td>Regional Air Model Results Pre-Project Ammonia (ug/m³)</td>
</tr>
<tr>
<td>4-80</td>
<td>Regional Air Model Results Pre-Project total Volatile Odorous Organics (ug/m³)</td>
</tr>
<tr>
<td>4-81</td>
<td>Regional Air Mode Results Hydrogen Sulfide Project (ppb v/v)</td>
</tr>
<tr>
<td>4-82</td>
<td>Regional Air Model Results Project Ammonia (ug/m³)</td>
</tr>
<tr>
<td>4-83</td>
<td>Regional Air Model Results Project total Volatile Odorous Organics (ug/m³)</td>
</tr>
</tbody>
</table>
HANCOCK PRO PORK
HOG FEEDLOT PROJECT

FINAL
ENVIRONMENTAL IMPACT STATEMENT

SEPTEMBER 15, 2003

Minnesota Pollution Control Agency
HANCOCK PRO PORK HOG FEEDLOT PROJECT
FINAL ENVIRONMENTAL IMPACT STATEMENT

This document contains the Minnesota Pollution Control Agency’s (MPCA) responses to the timely substantive comments submitted to the MPCA on the Draft Environmental Impact Statement (EIS) on the Hancock Pro Pork hog feedlot project, as required by Minn. R. 4410.2700, subp.1. Copies of all comment letters received by MPCA during the notice period are attached.

This document, and the Draft EIS document that was mailed on May 12, 2003, to interested parties, together comprise the Final EIS on the Hancock Pro Pork hog feedlot project, as provided in Minn. R. 4410.2700 subp.2. The Final EIS/comment response document is being distributed pursuant to Minn. R. 4410.2700, subp. 3. Any person who does not have the Draft EIS may obtain a copy by contacting the MPCA at the address below. A copy of the Final EIS will be posted on the MPCA Web site at http://www.pca.state.mn.us/news/eaw/index.html. In addition, the Final EIS can also be viewed at the following libraries: Fergus Falls Public Library, Hancock Community Library, Benson Public Library, Glenwood Public Library, Morris Public Library, and the Legislative Reference Library in St. Paul.

A public notice of the availability of the Final EIS is being published in the EQB Monitor on September 15, 2003, and a press release is being made available to media in the area of the project on the same date, pursuant to Minn. R. 4410.2700, subp.4-6. Pursuant to Minn. R. 4410.2800, subp. 2, publication of the public notice begins a ten-day public review period during which any person may submit comments to the MPCA on the adequacy of the Final EIS. This comment period will expire at the end of the day on September 29, 2003.

The Final EIS will be presented to the MPCA Citizens’ Board (Board) for a determination of adequacy on or about October 27, 2003. Any person may appear at this meeting and address the Board on the subject of the adequacy of the Final EIS. All parties on the mailing list for this project and any other interested parties who so request will be notified of the exact date, time, and location of this public meeting, and will also be mailed the Board memo and proposed Findings of Fact, Conclusions of Law, and Order that will be presented to the Board at that meeting for its approval and adoption.

Comments on the adequacy of the Final EIS, as well as, any questions about the remainder of the EIS process should be submitted to:

William J. Lynott, Project Manager
Operations and Environmental Review Section
Regional Environmental Management Division
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN  55155
(651) 296-7794
Minnesota Pollution Control Agency

Hancock Pro Pork Hog Feedlot Project
Environmental Impact Statement

LIST OF COMMENT LETTERS RECEIVED
Forty-five (45)-day comment period: May 12, 2003 to June 26, 2003


LATE COMMENTERS

Ivalene Cooley (received June 27, 2003 – one day late).
Norman and DiAnn Beyer (received June 27, 2003 – one day late).
David Preissler, Minnesota Pork Producers Association (received via email and unsigned July 9, 2003 -two weeks late).
Orrin Wilson (received July 9, 2003 - two weeks late).
RESPONSES TO COMMENTS ON THE EIS

1. Comments by Diane K. Anderson, Minnesota Department of Natural Resources (DNR).  

   Comment 1-1:  Commenter states the EIS appears adequate.

   Response:  None required.

2. Comments by Ginny Yingling and Kathy Norlien, Minnesota Department of Health (MDH).  

   Comment 2-1:  Commenter supports the use of background air pollutant concentrations in order to assess the impact of overall combined emissions. Use of monitored data to accomplish this is appropriate.

   Response:  None required.

   Comment 2-2:  The EIS does not make clear how modeled potential violations of the hydrogen sulfide standard at two project facilities will be mitigated, but commenter assumes the mitigation will be chosen from the list in table 6-1 of the EIS. Air permits and/or registrations for the two facilities should specify measures to be taken to assure compliance with the hydrogen sulfide standard, and a minimum of one year of continuous air monitoring should be carried out at the sites to assure compliance.

   Response:  The MPCA will require the farrowing/nursery site and the Schaefer site to implement mitigation to address the modeled hydrogen sulfide violations. Each of these facilities will be required to maintain the selected mitigation alternative as part of facility operations unless the MPCA approves a change in mitigation technology/option. Enforcement of the ambient hydrogen sulfide standard will occur through the facility permit, if required, or other controlling documents as appropriate and through the MPCA’s feedlot program procedures (periodic Jerome readings and response to complaints). All permits are based on the MPCA feedlot rules for compliance requirements or other MPCA rules such as the ambient air quality standards for hydrogen sulfide, and individual National Pollutant Discharge Elimination System (NPDES) or State Disposal System Permits, if required, may contain additional air quality conditions.

   Registration forms are not enforceable documents. They are instead census documents for the facilities (name, address, location, owner, type of animal, number of animals, etc.).

   Comment 2-3:  Mitigation should be employed at the Nohl and Solvie sites to reduce the potential to exceed the hydrogen sulfide standard at the property line.

   Response:  Modeling at the Nohl and Solvie facilities showed that they are not expected to violate ambient air quality standards for hydrogen sulfide. The MPCA cannot require air mitigation technologies without adequate justification.
**Comment 2-4:** If complaints arise, either mitigation should be implemented or further monitoring should be employed to verify a problem.

**Response:** The MPCA’s standard operating procedure in regard to odor complaints is monitoring with a Jerome meter to determine if the facility has a potential to exceed the state ambient air quality standard for hydrogen sulfide. Next steps are based on the result of this monitoring. This procedure would be followed in case of complaints at HPP facilities.

**Comment 2-5:** Perimeter tiles should be monitored at sites that use copper sulfate and 1,4 dioxane as pit additives in order to detect any leaks of these materials from manure storage pits.

**Response:** The monitoring for the presence of copper and/or 1,4 dioxane will be considered on a site specific basis accounting for pit location, design, construction and volume, compared to amount of pit additive introduced, methods used to introduce pit additives, and the hydrogeologic setting of each facility.

**Comment 2-6:** HPP facilities should use only non-medically important antibiotics for growth promotion.

**Response:** As noted in the EIS (section 3.7.4), concern is growing worldwide over the use of antibiotics at feedlots. As also noted (in the Generic Environmental Impact Statement (GEIS) and in section 4.5.1 of the HPP EIS), the influence of any one project is likely not significant (meaning in turn that eliminating such use at any one project would not solve the problem), and further that unilateral action by any one state may not be effective or legal, as explained in the GEIS. This is an industry-wide and nationwide issue and must be addressed on that basis. The GEIS recommends use tracking and support of federal initiatives aimed at protecting medically important drugs from the resistance phenomenon. As commenter notes, the MDH has gone on record (as did the GEIS advisory committee in its follow-up recommendations in the GEIS) supporting federal legislation that would ban the use of medically important antibiotics for animal growth promotion, so the state of Minnesota and the MPCA, through its role on the advisory committee, have weighed in on this issue at the appropriate level.

**Comment 2-7:** Land application areas with shallow ground water should be monitored to determine whether land application is affecting ground water quality, and if problems are found the application rate should be adjusted.

**Response:** During the feedlot rulemaking process, the MPCA evaluated the potential risks associated with land application. The MPCA established land application setbacks and best management practices to minimize these risks, compliance with which should assure protection of ground water. With tens of thousands of feedlots in the state, it is impractical to monitor all land application sites. Thus, with the aid of ongoing research by the University of Minnesota and others, the MPCA established specific rules governing land application of manure and believes the rules provide the necessary protection.

**Comment 2-8:** Fall land application should be allowed only at much less than agronomic rates. If HPP members propose fall application, MDH wishes to review the proposals.

**Response:** The MPCA appreciates the concern of the MDH in assuring that land application of manure follow best management practices. Permit documents are public data and open for review. As with all comments, the MPCA would consider any comments received from the MDH.
Comment 2-9: Stevens County requires setbacks of 200 feet and 50 feet from wells and tile inlets, respectively. These setbacks should be required of all HPP members.

Response: During the feedlot rulemaking process, the MPCA conducted numerous public hearings to gather testimony on the impact of its proposed minimum standards for land application of manure as well as other technical provisions in regard to feedlot management. Minn. Stat. § 116.07, subd. 7(k) states that county standards for animal feedlots in local ordinances may be more restrictive than the standards contained in MPCA rules. Additionally, the rules provide MPCA staff the authority to require, during the course of the review of a facility-specific manure management plan, additional safeguards depending on facility information and conditions at the land application sites. The commenter provided no justification as to why the Stevens County Conditional Use Permit requirements should be applied at all HPP facilities. Thus, the MPCA will use its rules and review the manure management plans accordingly.

Comment 2-10: The determination of available acreage for manure disposal should be based on subtraction of all setbacks from the gross total.

Response: In the final analysis, it is. Acreage for land application must account for setbacks; however, gross acreage is provided by the producer and is typically more than needed for the standard two- or three-year rotation used for determining agronomic rates. Gross acreage is typically used to show the land ownership involved in land application sites and to verify that the site is not being used for land application by more than one facility. The acreage needs with setbacks are reviewed by the MPCA and, when appropriate, MPCA staff require the producer to obtain access to more land if it is determined that the provided acreage with setbacks will not provide sufficient land application acreage based on the management practices.

Comment 2-11: Several surface water resources lie within the distance found by researchers to be at risk of atmospheric deposition of ammonium emissions. Reporting and spot inspections should be employed to assure strict compliance with manure management plans and setbacks, and consideration should be given to increasing the distance between land application activities and these surface water resources to minimize the deposition potential.

Response: The modeling conducted for the EIS showed that the HPP facilities emit relatively low levels of ammonia. Much of the research on atmospheric deposition that we are familiar with was performed in areas (such as Holland and North Carolina) characterized by very large concentrations of and/or very large feedlot facilities, which we expect would pose a much greater potential for ammonia emission and downwind deposition than is the case in Stevens and Pope Counties. Moreover, manure disposal in the areas where the research was done was, in many cases, accomplished by surface application and/or spray irrigation, both of which increase the potential for ammonia volatilization and air entrainment. Manure from the HPP facilities is typically incorporated into soils directly, which minimizes the release of ammonia into the air, and which in turn reduces the likelihood of significant deposition in the area.

Comment 2-12: Tile line monitoring should be required at all barn sites and spreading fields.

Response: In establishing the rules for land application of manure, the MPCA accounted for potential release to tile lines from properly managed manure. Appropriately managed in light of these rules, land application of manure from the HPP facilities should not pose excessive risks to tile lines sufficient to justify the expense and effort associated with tile monitoring. Similarly, modern concrete manure storage pits built according to MPCA specifications should not pose excessive risk of leakage that would indicate the need for monitoring of perimeter tiles.
Comment 2-13: A shallow (15-foot) residential well is located very near the Olson facility. Ground water monitoring should be employed to ensure that this well is not impacted by feedlot operations.

Response: The evaluation of this issue indicated that while the risk for potential ground-water contamination of the surficial aquifer may be elevated in the immediate vicinity of the barns, the well in question, which is upgradient from the barns, is periodically tested by the owner and found to have minimal levels of nitrate. To that extent, monitoring is being done. The well nearest the contamination area is used only by the hogs. Moreover, actual monitoring of the surficial aquifer at the barn site by MPCA indicated denitrification was occurring.

Comment 2-14: The EIS did not address the possibility that abandoned wells may be located in spreading fields. Aerial photos back to the 1930s should be reviewed to determine whether buildings likely to have wells ever existed in these fields. If any are found, they should be closed according to law. If suspected wells cannot be actually located, a 100-foot no-manure buffer should be observed around identified building locations.

Response: The commenter did not provide data indicating that actual abandoned wells exist in the area. The review of manure management plans as part of the permit review process evaluates the need for setbacks due to abandoned wells. The mere existence of buildings at a site in the past does not by itself indicate that a well existed or continues to exist, since above/below ground cisterns were sometimes used instead of wells, and sandpoint wells at abandoned farmsteads were often eliminated by simply pulling them out and the hole collapsing.

Comment 2-15: In order to limit the potential for vector-borne disease, HPP should continue steps to ensure that animals cannot access waste storage or barn areas.

Response: The MPCA agrees. This will be passed on to HPP.

Comment 2-16: Burial of mortalities should be prohibited where ground water is less than 10 feet below ground surface. In light of the history of noncompliance with minimal mortality management requirements, a mechanism should be developed to assure future compliance.

Response: The burial of mortalities is addressed by Minnesota Statutes (35.82) and the Minnesota Board of Animal Health (BAH) rules (Minn. R. 1719.0100-1719.4600). The BAH program provides for a five-foot separation between buried mortalities and the water table, and no reason has been given that would justify departure from the program guidelines. On the other hand, since the BAH program calls for a minimum of three feet of cover between the surface and buried mortalities, and the mortalities themselves will account for some depth, it is likely that commenters recommendation will be followed in many cases.


Comment 3-1: Commenter states the EIS will meet the standards for a determination of adequacy.

Response: None required.

Comment 3-2: The EIS statement that the air modeling suggests the potential for annoying off-site odor episodes at the farrowing and Schaefer sites appears to exaggerate the problem, since the EIS also states that the modeling also suggests that the nearest neighbors would experience only detectable but non-annoying odors.
Response: The MPCA does not agree that the EIS exaggerates the problem. As commenter himself notes, the EIS is clear in indicating that the estimated hourly total Volatile Odorous Organic Compound (tVOOC) concentrations did not exceed the 70 microgram per cubic meter (µg/m³) threshold for annoying odors at the nearest residences. On the other hand, the air quality modeling results suggest that some of the HHP sites can emit annoying odor plumes that do extend beyond the site’s property lines. These results are important to users of public roads and potential builders of new residences (if county setback distances are insufficient). All things considered, the MPCA believes the EIS accurately and appropriately characterizes the potential for odor impacts.

Comment 3-3: A column should be added to table 4-80 with the heading “Potential for Annoying Odor to Reach Nearest Neighbor.”

Response: This information is clearly presented in the text. The MPCA does not believe an additional column is needed on Table 4-80. The column would not change the results of the model or the facts provided in the EIS.

Comment 3-4: The EIS statement that model results underestimated monitor results could be interpreted to mean that modeling always underestimates actual impacts. Commenter does not believe this would be a sound conclusion.

Response: The MPCA agrees this would not be a sound conclusion, but notes that the context surrounding the statement on page 90 makes it clear that such a generalization should not be inferred.

Comment 3-5: It is not clear from the EIS discussion whether agitation and pump-out emissions were included in the monitored values given in Figure 4-3. If they are, the comparison between monitored values and model results may not actually show good agreement.

Response: The monitored results graphed in Figure 4-3 deliberately excluded the period in November 1999 when agitation, pump-out, and land application occurred.

Comment 3-6: Commenter is surprised that the background values used in the air analysis are so high, and suggests that emissions from agitation and pumpout, land application, or manure transport on adjacent sites, may have caused them to be elevated. Commenter requests additional information on background development methodology.

Response: The monitored hydrogen sulfide concentrations that occurred with winds blowing from directions other than the HHP facility (i.e., those that were used in the calculation of background) may have come from other feedlots, natural emissions from wetlands or surface water, industrial emissions, or from land application by other parties. Feedlots are now allowed to claim an exemption from state ambient air quality standards during agitation and pump-out periods [Minn. Stat. § 116.0713 Livestock odor. (b)]. Under this law, livestock production facilities are exempt from state ambient air quality standards while manure is being removed and for seven days after manure is removed from barns or manure storage facilities if the operator claims the exemption. The operator of a livestock production facility that claims this exemption must provide notice of that claim to either the pollution control agency or the county feedlot officer delegated under section 116.07. Some of the monitoring occurred before this statute was passed by the legislature. Subsequent to passage, we have no records of feedlot operators requesting exemptions during the monitoring periods used for calculation of background concentrations.
It is also true that the exemption applies to monitored violations of the hydrogen sulfide standard and not to the development of background concentrations to be used in modeling analyses for environmental review purposes. Based upon these considerations, the concentrations measured during times when winds were not blowing from the facility towards the monitor were included in the calculations.

The background determination itself was based on the standard U.S. Environmental Protection Agency (EPA) guidance for background determination. When determining a background hydrogen sulfide concentration, Continuous Air Monitor (CAM) data from the HHP farrowing site was limited to hydrogen sulfide readings associated with wind directions from 0 degrees Fahrenheit (F) to 270 degrees F. Any field application of manure by HHP and its neighbors and any manure pumping activities by neighbors may in fact have contributed to the observed background concentration, if the wind direction was between 0 degrees F and 270 degrees F and was blowing across the active spreading field or barn before reaching the farrowing-site CAM. Minn. Stat. § 116.0713 only addresses potential violations of the hydrogen sulfide standard and says nothing about the potential role of off-site land application on background concentrations. Nor does the EPA guidance create any distinctions or exclusions regarding sources in the determination of background at a monitored site.

Comment 3-7: Commenter is concerned that repeated statements in EIS section 4.2.1 to the effect that the combination of shallow ground water and granular soils in some spreading fields elevates ground-water contamination potential may mislead reviewers into thinking that a serious problem exists. EIS statements elsewhere that denitrification with depth and spring application on granular soils tend to mitigate this potential are contrary to this impression.

Response: The MPCA does not agree that this creates a false impression. There is really no other way for an EIS to do its job than to identify where impact potential exists and follow this with a discussion of the ways, if any, in which the potential is reduced.

Granular soil and shallow ground water are factors that increase the risk of ground-water contamination. Although nitrate reducing conditions with depth below the water table are apparent throughout the area, the shallow water system can still be impacted. Where shallow ground-water flows vertically downward and is recharging lower aquifer units, the ground-water data suggest nitrate reduction is occurring. Where shallow ground-water interacts with the surface water, reducing conditions may not be present. Therefore, the shallow ground water may potentially be a source of nutrient loading to the surface waters, and it is therefore not prudent to rely on reducing conditions to eliminate the problem area wide.

Any individuals now or in the future utilizing the shallow water supplies in this area may be subjected to elevated nitrate concentrations stemming from past, current, or future agricultural practices. This has been established by other research and experience, not just this EIS. In order to avoid elevated nitrate concentrations, drinking water wells will sometimes need to be installed in deeper aquifers in order to obtain reducing water (i.e. water with low nitrate). The MPCA believes the potential for ground-water impacts exist and the EIS documents this risk. The EIS also discusses the natural phenomena and manure management practices that may tend to reduce the risk. This is what an EIS does and should do.

Comment 3-8: The EIS appears to have addressed some issues (antibiotic resistance, endocrine disruptors, and animal mortality management) that were not listed in the scoping document.

Response: These issues did not broaden the scope. The scoping document is itself, in practical terms, a compilation of the overarching issue areas that are to be addressed in the EIS, and may not specify each and every study that will be performed in order to adequately address those issues. Antibiotic resistance
was included in the EIS because the document needed to address impacts to human/public health (which is in the scope), and because it was known to be an issue of concern to the public. The same is true of endocrine disruptors and mortality management, with the added concern that these items can have adverse effects on wildlife and ground- and surface-water quality in the area. These are all legitimate for an EIS to address and the plan from the beginning was to include them.

4. **Comments by Curt Gadacz, Lake County. Email dated May 16, 2003.**

**Comment 4-1:** Commenter, who is a former feedlot operator forced out of business by “increasing economic strain and government intervention,” asks where people will get their groceries when all the farmers are gone.

**Response:** This is not a likely scenario. However, the structure and makeup of the food industry has changed a great deal over time, and likely will continue to change. That said, the HHP EIS is a project specific document that by definition does not perform a general review of the agriculture industry. It therefore does not attempt any analysis of the changing nature of agriculture as a whole. Instead, it identifies such environmental issues as potentially posed by the project and identifies possible mitigation options (if needed and appropriate) for those issues. This information can then be used by decision makers and the public to decide on appropriate management to minimize whatever adverse effects the project poses.

**Comment 4-2:** Commenter suggests that MPCA could introduce legislation allowing the state to buy out and close all farms and import food from China or Russia instead.

**Response:** See previous response.


**Comment 5-1:** The hydrogen sulfide background values used in the air impact analysis are unrealistically high. While monitored data is appropriate to use for background value generation, it must be properly analyzed. However, the farrowing site monitor data was not (and should have been) used to generate background values for all HPP sites; the EIS analysis did not follow MPCA and EPA guidance that allows background value generation as a percentage of the standard; the higher monitor readings at the HPP farrowing site may have been influenced by other nearby sources that should, per state and federal guidance, have been modeled as separate sites; and, any monitor readings resulting from agitation and pumpout should be thrown out based on the exemption from standards allowed for such activities by state law. The MPCA and HPP should perform a “more rigorous” analysis of monitored data, with the aim of eliminating readings that should not be included and developing more realistic background values, per the above. Commenter believes the intent of background development is to generate values that are representative of typical conditions, rather than the maximum concentration ever observed.

**Response:** The background concentrations were developed from monitored data and the calculations employed guidance developed by EPA and MPCA. It should be emphasized that the background concentration is not necessarily the same as the long-term average concentration. The ambient air background concentration is typically taken as the value monitored over the same timeframe as the averaging period for the air quality standard of concern. For an annual average standard, the background concentration would typically be taken as the monitored long-term average concentration, but for short-
term standards like the Minnesota Hydrogen Sulfide standards (one-half hour average standard), the background concentration would usually be taken as the “Nth” highest short-term average concentration monitored over a specified time period (“N” depending on the form of the standard).

The Minnesota hydrogen sulfide ambient air quality standard has two forms. The 0.05 parts per million (ppm) (50 ppm) standard is a one-half hour average not to be exceeded more than twice per year. Starting with representative air monitoring data, and based on EPA guidance, the appropriate hydrogen sulfide background concentration for this standard would be the third highest (allowing two exceedances) one-half hour average recorded over one year of monitoring. The 0.03 ppb (30 ppb) standard is a one-half hour average not to be exceeded more than twice in any five consecutive days. The establishment of the appropriate hydrogen sulfide background concentration for this standard, again following EPA guidance, involved looking at every five-day period of monitoring data and selecting the third-highest concentration during the period. The highest third-highest concentration was taken as the appropriate background value. Stated differently, the concentrations taken as background values actually occurred over the relevant time periods at the HHP monitoring site.

The comment suggests that times of agitation, pump-out, and land application by HHP and other feedlot operators should not be considered in the calculation of background concentrations. However, the exemption from air quality standards during periods of agitation, pump-out and land application (see response to comment 3-6) did not exist during the 1999 periods indicated in the comment, and during subsequent periods, notification of a claim of exemption was not provided. But it is also true that the exemption applies to monitored violations of the hydrogen sulfide standard and not to the development of background concentrations to be used in modeling analyses for environmental review purposes. Therefore, these values were included in the calculations of background. Put differently, the exemption, even had it existed during the period in question, and even had the operators claimed it, is only intended by law to relieve the operators of the necessity for complying with the hydrogen sulfide standard; it does not eliminate the monitor readings from background calculations.

The comment also suggests that other feedlots in the area should have been explicitly modeled and a lower background concentration used. This suggestion assumes that the other identified feedlots are the only sources of hydrogen sulfide concentrations other than the HHP farrowing site itself. However, the MPCA’s cumulative modeling analyses indicated that other feedlots were expected to contribute very little to the monitored concentrations at HHP. Furthermore, other sources besides other feedlots may contribute significantly, such as natural emissions from wetlands or surface water, industrial emissions, or emissions from land application by other parties. Since information was not available on these types of sources (except industrial sources, which the MPCA believes do not contribute at the HHP site), the only way to consider these sources in the analysis was to use a background concentration derived from the monitoring.

**Comment 5-2:** The MPCA’s hydrogen sulfide standard is based on annoyance potential, not on human health impact potential, and is therefore conservative as regards the latter. Any public exposure to hydrogen sulfide emissions from HPP sites would be “infrequent and brief,” and would merely cause annoyance rather than impact human health. Commenter recommends insertion of language in the EIS that makes clear that the modeled impact potential at the farrowing and Schaefer facilities should not be assumed to represent adverse human health impact potential, and in fact does not represent such potential.

**Response:** It is not accurate to state that the MPCA’s hydrogen sulfide standard is based on annoyance potential and not on human health impact potential. The MPCA’s ambient air quality standard for hydrogen standard is a primary standard. That is, this standard accounts for human health impacts as well
as quality of life issues (i.e., odor). The argument that any hydrogen sulfide impacts would be “infrequent and brief” is irrelevant from a compliance/impact assessment standpoint, which is the purpose of modeling. In the course of the HPP EIS analysis, air emission dispersion modeling was performed that suggested the potential for violations of this standard at the fenceline. Since the law requires that this standard be met at that location, a violation is and must be regarded as a de facto significant impact that in turn indicates the need for mitigation. It is not appropriate for an EIS to “second guess” this standard by evaluating whether the standard is or is not “conservative” or whether or not an “infrequent and brief” exposure would cause adverse effects to human health.

Comment 5-3: EIS statements that anaerobic digestion has potential for cost recovery are prejudiced by the lack of detailed information about capital, operation and maintenance costs as well as the cost of retrofitting to an existing facility, and lack of clarity about the pollutants controlled by the technology. Use of this technology would involve significant infrastructure changes at the HPP farrowing barn. Many of the digesters described in the EIS are supported by government subsidies. Commenter suggests rewording of the EIS conclusions on the feasibility of anaerobic digestion.

Response: It was not the MPCA’s intent that the EIS would contain detailed cost, technical, and operation data for specific applications. Such an analysis would only be appropriate if this technology had been decided on at this time as the mitigation at a specific site. Instead, the intent here was to provide a list of mitigation methods and technologies along with an assessment of their pros and cons, so that operators and regulators could begin to think about what might be appropriate for one to propose and the other to approve. Many of the negative statements commenter makes about anaerobic digestion (such as that it would require significant changes in site infrastructure) were made in the EIS as well, meaning the MPCA is aware of them and would take them into account in any decisions about what mitigation is appropriate at a particular site. On the other hand, other EIS statements cited by commenter (such as that anaerobic digestion “poses considerable cost recovery potential”) are true statements as they stand, and are fully supported in the text by literature citations and related analysis. In sum, the current text factually and appropriately describes the pollution control and cost recovery potential of anaerobic digestion. Commenter’s suggested language would add nothing to this discussion.

Comment 5-4: EIS statements that biofiltration would be a relatively inexpensive and easy-to-operate air impact mitigation strategy may not be correct for HPP. Retrofitting a biofilter to the farrowing barn would pose significant engineering and feasibility issues. Commenter suggests language to address this. The $0.28 per piglet cost cited in the EIS is not shown to be applicable and should be deleted.

Response: See preceding response. Again, the EIS was not intended to give a detailed site specific construction plan and feasibility study for a biofilter at a specific site, but instead to give an idea of the chances for success in the main purpose, which is meeting air quality standards, and what the practical obstacles, including retrofitting and cost, might be. The current text does this. The citation of the $0.28 per piglet cost of biofiltration was intended, again, to provide some context rather than a site specific evaluation. It is important to note, however, that this figure was taken from the scientific literature and was developed by reputable workers in the field who have constructed and operated working biofilters that have worked well at hog feedlots. At least one of these was a retrofit situation that, judging by their account of it, was readily constructed in a relatively small space with inexpensive materials, and worked well. Most importantly, the MPCA believes that the EIS text on this subject provides reliable information that can be used by reviewers to judge whether this kind of mitigation should be further evaluated for use at HPP facilities. Finally, it should be noted that, in light of EIS data indicating that the nursery barn may
be the biggest odor source at the farrowing site, the still-to-come site-specific evaluation of mitigation needs (during the permitting process) may show that the farrowing barn will not need mitigation applied to it.

**Comment 5-5:** The use of extended stacks as a mitigation method for air impacts should be included in the EIS. Commenter suggests language for this purpose.

**Response:** Increasing the height at which the emissions from mechanically-ventilated hog barns are released into the atmosphere has, at least, the potential to reduce downwind concentrations of hydrogen sulfide, ammonia, and tVOOC. Of course, this relies on dilution of the pollutant stream rather than treatment. Also, simply installing an elbow and a length of straight pipe onto an existing pit fan’s shroud does not guarantee reliable performance and compliance with air quality standards. Sufficient momentum, buoyancy, or both must be imparted to the exhaust to ensure the desired degree of dispersive mixing before the plume reaches the ground. Downwash and unfavorable wind currents around the hog barns can also negate any advantages associated with increasing the release height.

Extended stacks have been used at industrial sites as a means to help meet air quality standards. However, in virtually every case, these facilities are combustion sources, which by definition are sources that impart (via added heat) momentum and buoyancy to the exhausted pollutants. A feedlot is not a combustion source, and the required increases in momentum and buoyancy would have to be imparted via other means, perhaps by larger fans. This could result in significant ongoing operation costs. It is worth noting as well that, when evaluating air permit applications, the MPCA has required, as part of the permit application, operator-funded modeling of the sources to determine the potential for compliance, and we have a number of standards against which to judge the results. Presumably, this would be required at a feedlot, as well.

Extended stacks have never, to our knowledge, been evaluated as a mitigation technology in a feedlot application, as have, for example, anaerobic digesters and biofilters. Short stacks connected to manure reception basins were used briefly at two dairies in Minnesota, but these were disconnected in favor of biofilters when it became clear that the stacks caused hydrogen sulfide problems. With these exceptions, no operational or design history exists to evaluate the performance or reliability of such a system, nor is there any information known to us on costs, working life, ease of operation, or efficacy. The EIS by design first discussed mitigation methods for which there is, at minimum, some sort of “track record” upon which to base a judgment about their feasibility. The discussion was reduced (beginning in section 6.4.1) to those methods judged by the MPCA to be appropriate for further consideration, based on the information and experience available. The EIS also notes in several places (for example, on page 168) that “[o]ther air emission control methods may be considered on a case-by-case basis, but would require more of a demonstration of potential for success than has been found to date in the literature or documented field experience…” The goal of the EIS, in this instance (in section 6), is to highlight those methods in which the MPCA and the public might have some confidence, based on information from documented research and experience. Extended stacks do not, to date, fall into this category.

That said, the MPCA decided to perform a limited analysis of this method with the tools available. The following is the result of that limited analysis.

In the EIS, the HPP farrowing site was modeled as releasing air emissions at a height of 3.66 meters, which is half the height of the buildings. In this limited evaluation of extended stacks, the farrowing site was remodeled with the release heights for the farrowing and nursery barns increased from one-half their
height (i.e., 3.66 meters) to 4.6 meters (the height proposed in the comment above). Instead of the simple screen model used by the commenter, the MPCA evaluation made use of the same modeling tools as those upon which the EIS analysis is based, including the use of CALPUFF.

The buoyancy of the emitted air was a function of the temperature difference between the ambient air and the exhausted air. The emitted plume is less buoyant on hot days. The modeling did not consider the additional of larger exhaust fans to impact more vertical momentum to the exhausted air. Hence, the modeling approximates the addition of an elbow and a short length of pipe onto an existing exhaust fan’s shroud.

The estimated maximum hourly property-line concentrations are provided in Table 1 (below). Increasing the release height as proposed by the commenter reduced the estimated maximum hourly concentrations for the North and South Property Lines by about 47 percent and for the East and West Property Lines by about 16 percent. Despite the favorable reductions, the modeling results still suggest compliance issues with the 30-ppb hydrogen sulfide standard. With a background concentration of 21 ppb, all four property lines have estimated maximum hydrogen sulfide concentrations that exceed 30 ppb. Time-series analysis with the 21-ppb background indicates ten potential violations of the 30-ppb standard (no more than two exceedences of 30-ppb within a five-day period) for a North Property Line receptor. No violations of the 30-ppb standard were modeled for the South Property Line, which represents an improvement over the 3.66-meter release height (21 potential violations).

### Table 1. Maximum hourly property-line hydrogen sulfide concentrations for the farrowing site assuming a release height of 4.6 meters (15 feet) for the farrowing and nursery barns.

<table>
<thead>
<tr>
<th>Location</th>
<th>Hydrogen Sulfide Concentration Without Background (ppb, v/v)</th>
<th>Hydrogen Sulfide Concentration With a 21 ppb Background Value (ppb, v/v)</th>
<th>Hydrogen Sulfide Concentration With a 32 ppb Background Value (ppb, v/v)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Property Line</td>
<td>22.08</td>
<td>43.08</td>
<td>54.08</td>
</tr>
<tr>
<td>East Property Line</td>
<td>13.85</td>
<td>34.85</td>
<td>45.85</td>
</tr>
<tr>
<td>South Property Line</td>
<td>15.60</td>
<td>36.60</td>
<td>47.60</td>
</tr>
<tr>
<td>West Property Line</td>
<td>13.54</td>
<td>34.54</td>
<td>45.54</td>
</tr>
</tbody>
</table>

Table 1 also indicates that the potential to exceed the 50-ppb standard continues to exist along the North Property Line when the site’s background concentration of 32 ppb is added to the CALPUFF results for the 4.6-meter release height, although time-series analysis indicated no potential violations of the 50-ppb standard.

As indicated by comparing Figures 1 and 2 (below), a general decrease in estimated local hydrogen sulfide concentrations is obtained when the release height for the nursery and farrowing barns is increased from 3.66 meters to 4.6 meters. However, the modeled increase in release height is insufficient to eliminate potential exceedences of the 30-ppb hydrogen sulfide standard. As indicated in Figure 2, estimated maximum off-site concentrations of hydrogen sulfide exceed 15-ppb both north and south of the farrowing site. With a background concentration of 21 ppb, the estimated off-site hydrogen sulfide concentrations exceed 36 ppb.
Figure 1. Maximum hourly hydrogen sulfide concentrations (ppb, v/v) without background for the HHP farrowing site assuming a release height of 3.66 meters for the nursery and farrowing barns. The spatial origin (0, 0) is the southwest corner of the farrowing site.
Figure 2. Maximum hourly hydrogen sulfide concentrations (ppb, v/v) without background for the HHP farrowing site assuming a release height of 4.6 meters for the nursery and farrowing barns. The spatial origin (0, 0) is the southwest corner of the farrowing site.

The above modeling results suggest that simply increasing the release height of the nursery and farrowing barns is an insufficient means of mitigation. The momentum and buoyancy issues associated with the exhaust, especially for hot weather conditions, must be addressed. Weather-induced downwash remains a concern, even for well-designed exhaust stacks.

In sum, while MPCA will not refuse to consider mitigation methods not addressed in the Draft EIS, any such methods would carry a burden of proof of feasibility and efficacy, as the EIS notes. In this sense, extended stacks fall into the same category as other unproven methods. The list of air mitigation methods presented in the HPP EIS was culled from the Animal Agriculture GEIS, based upon judgments of feasibility, expected costs, efficacy, and other factors. Under the circumstances, inclusion in the HPP EIS of extended stacks as a mitigation method is not appropriate.

Comment 5-6: Rather than state that HPP members should either apply manure in the spring on granular soil or propose a means by which fall application could be done without harming ground water, the EIS should simply state that the members have already made the commitment to apply in the spring.
Response: The comment is acknowledged. However, an important EIS goal was and is to allow for the possibility of alternative methods of accomplishing environmental objectives so as to have the opportunity to choose the best fit at the appropriate time.

6. **Comments by Mark Ten Eyck, Minnesota Center for Environmental Advocacy. Letter dated June 4, 2003.**

**Comment 6-1:** Some Pope County residents report threats of physical and economic retaliation against them for speaking out on the subject of feedlot related issues. The MPCA should tell law enforcement officials that such complaints must be investigated and prosecuted.

**Response:** The MPCA’s enforcement powers do not extend to matters such as these. That said, anyone who has been the victim of such threats should bring them to the attention of the proper local enforcement authorities for appropriate action.

**Comment 6-2:** Recent legislation has exempted feedlots under 1,000 AU capacity from environmental review unless they are in a sensitive area. However, the EIS makes clear that feedlots below this capacity may pose environmental impact potential. MPCA could address this concern by requiring air modeling for all feedlot permit applications at the 400 AU level and above, or for any facility with the same characteristics as those shown previously by modeling to pose impact potential.

**Response:** This EIS is limited to an evaluation of the HPP facilities and to a discussion of mitigation alternatives in those cases where the EIS analysis identifies a problem. Based on the EIS analysis (air emission modeling) and actual air monitoring at swine facilities, the MPCA does not believe sufficient evidence exists to support the requirement of modeling at all facilities at the 400 animal units (AU) level and above.

**Comment 6-3:** Recent legislation has exempted feedlots under 1000 AU capacity from environmental review unless they are in a sensitive area. However, the EIS makes clear that feedlots below this capacity may pose environmental impact potential. The MPCA could address this concern by requiring routine review of manure management plans with respect to soil types and surficial aquifers.

**Response:** While the EIS does show that feedlots smaller than 1,000 AU may have impact potential, it also shows that a number of things, including compliance with current rule requirements, injection of manure, spring application, and ground-water denitrification with depth, all tend to reduce and even minimize this potential. It is not necessarily true that impact potential translates inevitably to actual impact. It is also true, however, that under current rules MPCA reviews manure management plans as part of the facility review process, and includes consideration of soil types and ground water in that review, to the extent that sufficient land must be available for manure disposal at agronomic rates and agronomic rate application is required. Manure application records must be kept showing that these requirements were followed. The review of manure management plans is performed by delegated counties and/or MPCA staff, including inspections of records. There are other safeguards for feedlot construction in karst areas or where drinking water supply management areas are designated as vulnerable to pollution from the surface (see for example Minn. R. 7020.0405).

**Comment 6-4:** Given that the farrowing facility is built and operating, and given further that an NPDES permit will be required for it, the EIS should reflect that the terms and conditions under which it operates in the interim are at least as stringent as those that will apply once the permit is issued, and that the operator knows this and agrees.
Response: The EIS is an informational gathering, rather than a decision-making, tool. The information gathered during the EIS will be used by the MPCA in making facility-specific decisions. For the record, MPCA has been keeping HPP informed about rule and permit application requirement changes as they have been adopted. HPP has been upgrading its documents and processes as they are informed of these changes. HPP is currently up to date on all of the latest requirements. Also, HPP agreed at the time of EAW completion to apply manure to granular soils only in the spring, and continues to abide by this agreement.

Comment 6-5: The EIS should state whether an individual or general NPDES permit is required, and explain the rationale for the choice.

Response: Final permit decisions (type and/or conditions) will be made after the EIS process is complete and will employ the information gathered during the development of the EIS.

Comment 6-6: The EIS should spell out how the manure management plan will be revised to assure protection of shallow ground water. Options considered must be made available for public review, and revision if necessary. No option should be considered if public review is not allowed.

Response: The review of specific facility manure management plans is a component of the permitting process. In light of the information contained in the EIS, a review of the manure management plans and the mitigation alternatives provided by the facility owner will be conducted and approved/disapproved by the MPCA. Another alternative to spring application of manure would be a late fall application of manure. Late fall would be at a time after soil temperatures fall below 50 degrees F, but before freeze up. When soil temperature falls below 50 degrees F, microbial activity is slowed sufficiently to reduce the conversion of ammonia to nitrate. This in effect reduces the amount of nitrate in the soil available for leaching during the winter and early spring recharge events.

A second alternative to spring application would be to reduce the application rate of the manure applied in the fall and supplement the crop nutrient needs with spring application of commercial fertilizer. This also would reduce the amount of nitrogen in the system available to leach. These options were not discussed in the EIS because HHP had already agreed to spring application on granular soils.

Comment 6-7: In light of the project’s history of inadequate record keeping, and in light of the recent legislative action to eliminate environmental review for feedlots under 1,000 AU, the EIS should state that compliance with record keeping requirements will be monitored. The EIS should also state that this will be done for all feedlots statewide.

Response: The EIS addressed the specific compliance situation associated with the facilities under review. The requirement for detailed record keeping became effective October 23, 2000. The MPCA in the course of its permit application review process and compliance inspections has established a protocol for the review of required records. The requested statement on the MPCA statewide policy is not appropriately a component of a site specific EIS. However, a land application records review is required at all NPDES feedlots (although not at all feedlots).
7. **Comments by Bob P. Bowlin, Pope County Mothers and Others Concerned for Health, Inc.  Letter dated June 26, 2003.**

**Comment 7-1:** The EIS successfully addressed some issues, but did not address others.

**Response:** Commenter provides no specifics.

**Comment 7-2:** Commenter has provided a Web link to an article on hydrogen sulfide and ammonia emissions from lagoons.

**Response:** The MPCA staff tried to follow this link, but it did not work.


**Comment 8-1:** Commenter fears that MPCA will ignore the results of the EIS, either willfully or through coercion.

**Response:** By law, EISs are intended to guide permitting processes, aid regulatory authorities in minimizing environmental effects, and to aid in restoring and enhancing environmental quality. The MPCA has every intention of abiding by this law.

**Comment 8-2:** The EIS makes clear that the legislature should require thorough study for all moderate and large sized facilities. Some HPP facilities house less than 1,000 AU, but are shown by the EIS to have problems requiring solutions. Without this EIS, no one would know that.

**Response:** See response 6-3.

**Comment 8-3:** Commenter is especially concerned about the overuse of growth hormones and antibiotics.

**Response:** See response 9-11.

9. **Comments by Karna Peters, Pope County Mothers and Others Concerned for Health, Inc.  Letter dated June 26, 2003.**

**Comment 9-1:** The EIS found that several of the HPP sites have serious impacts requiring mitigation, yet most are under 1,000 AU in size. This is significant since the legislature has eliminated environmental review for feedlots under this size, relying instead on compliance with the feedlot rules to assure environmental protection. The EIS findings show that, in reality, feedlots over 500 AU need to be analyzed as HPP was.

**Response:** Commenter’s opinion is noted. However, this EIS deals solely with the potential for impacts posed by the HPP project. Based on the EIS analyses for impacts to the various media, the MPCA does not believe sufficient evidence exists to support the requirement of an EIS-like analysis be completed at all facilities over 500 AU.
Comment 9-2:  Commenter agrees that fall manure application on granular soils poses more risk than spring application, but requests more information on the risks posed by spring application. Are there additional mitigation or reporting measures that should be required to reduce those risks? Would application of manure in solid form be better?

Response:  Research indicates that when manure is applied at agronomic rates, leaching of nutrients is minimized. The best protection the ground water has is to insure nutrients are not applied above the agronomic rates for the crop. The second best protection is to apply the nutrients at a time when crops can use the nitrogen and in a form the crop can use. Liquid swine manure contains nitrogen in the forms that are readily available for crop use. Therefore, spring and early summer applications will provide the right form of nutrients to the crop at the time the crop needs these nutrients. The application of solid manure in the spring would not minimize the likelihood of ground-water contamination. Solid manure has a much higher percentage of organic nitrogen. Organic nitrogen is not readily available for plant uptake. Applying solid manure in the spring would potentially increase the risk to ground water. The organic nitrogen takes time to break down into a form that can be used by plants. This time lag may mean that some of the nitrogen in the system is not available until after the growing season, in which case it would be susceptible to leaching. The current record keeping requirements are prescribed by rule and are adequate to assure compliance.

Comment 9-3:  MPCA should have performed manure testing to confirm the accuracy of manure management plans as well as to determine levels of pathogens and heavy metals.

Response:  Heavy metal and pathogen testing is not required of feedlot owners. The level of metals and pathogens in manure has been well analyzed by research institutions, and the MPCA cannot perform manure testing to this level. There is nothing to suggest that manure from the HPP facilities is in any way unique and deserving of extraordinary efforts to characterize it.

Comment 9-4:  While emphasizing spring manure application as mitigation for shallow ground water contamination potential, the EIS leaves open the possibility that fall application with safeguards could be proposed later on. The EIS provides no specifics on how manure could be safely applied in the fall on granular soils. If such a thing is possible, the EIS should specify how it would be done. Any future proposals of this type should be available for public review, and if this cannot be done this option should not be allowed.

Response:  See response 6-6.

Comment 9-5:  The EIS notes the presence of a domestic well on the Olson site, and also notes the presence of elevated nitrate levels in ground water on this site. However, the EIS also concludes that this is no problem due to denitrification with depth in the aquifer. Commenter questions this conclusion.

Response:  There is no statement in the EIS that we can find that high nitrate levels in the vicinity of the Olson barns is not of concern because of denitrification with depth. In actuality, Olson’s domestic supply well is located upgradient from the feedlot facility and is thus not in danger of being impacted by the operation. Onsite data gathered from the Olson facility by MPCA staff indicated reducing conditions with depth and the reduction of nitrate in the ground water system. These reducing conditions deeper within the surficial aquifer provide a level of protection against nitrate contamination in this case. Finally, Olson reports periodically testing his well and always finding very low levels of nitrate in it.
**Comment 9-6:** The EIS does not explain the source of the elevated levels of ground-water nitrate found at the Olson site. The EIS should further analyze this and recommend management practices to reduce the levels if appropriate. The EIS should confirm that there are no domestic wells shallow enough to be affected by the elevated nitrate levels.

**Response:** The most likely source of the elevated nitrate near the Olson barns is runoff from the barns themselves. The Olson operation is an open lot, manure pack operation, and does not have a manure pit storing liquid manure. When MPCA geoprobred in this area, the intent was to determine the extent to which open lot runoff might affect ground water. One of the findings was that, due possibly to dilution and reducing conditions with depth, nitrate was considerably reduced at the facility boundaries. Olson’s own domestic well is upgradient from this area, and has been tested periodically and found to be low in nitrate.

Since this is not an immediate threat to public health, Olson has until October of 2005 to sign up for an Open Lot Agreement, under which issues such as this are addressed.

The EIS analysis used available data (such as county well records) in its attempt to identify all wells located in the study area. Several databases, field surveys, and published data were used to identify well locations and depths. The MPCA believes this represents an adequate level of effort to identify and characterize wells in the area. The analysis did not find any wells in the area that are likely to be significantly affected by the limited areas of elevated nitrate attributable to the project.

**Comment 9-7:** The EIS did not analyze at every site the possibility of manure storage structure leaks. Monitoring wells should be required where soils are granular.

**Response:** The EIS adequately addresses the potential for leakage from the concrete pits constructed in accordance with approved standards. This potential is minimal, which is the intent of the standards and of the requirement that MPCA approve plans and specifications before building can commence. Only one facility does not have a concrete pit and that is the Olson site, which is a very small facility and stores manure as a solid. The MPCA report, “Effects of Liquid Manure Storage Systems on Ground Water Quality” addressed the risks to ground water from various manure storage structures.

**Comment 9-8:** The EIS states [page 34] that the farrowing facility requires an NPDES Permit but does not have one. The MPCA should not wait until the environmental review process is complete before issuing the NPDES Permit to the farrowing facility, since the permit is required under federal law, and without it, the facility is subject to enforcement under the Clean Water Act.

**Response:** This comment contains a legal conclusion by the commenter. The MPCA takes no position on this conclusion, and cannot give legal advice to private parties regarding it. Moreover, the EIS notes (section 2.4.5.2) that permits cannot be issued until environmental review is complete. This is a requirement of state law (Minn. Stat. § 116D.04, subd.2b; Minn. R. 4410.3100, subp.1). Further, as the EIS also notes in the same section, the farrowing facility continues to be regulated by the provisions of the expired Interim Permit; this includes such requirements as spring application of manure on granular soils. The applicable portions of Minn. R. ch. 7020 apply as well. It would not be correct to infer that, because the final NPDES Permit has not yet been issued, the facility is not subject to regulatory requirements. Issuance of operating approvals prior to environmental review completion was one of the reasons cited by the Pope County District Court for its order to prepare an EIS, in a case brought by this commenter.
Comment 9-9: The EIS notes that perimeter tile drainage at the Paul site initially drained to a wetland, but this was changed at the direction of the MPCA after an inspection. What are the regulatory requirements for such drainage? Should a permit for it have been required? Where does the tile drain to now?

Response: The drainage to the DNR Protected Wetland at the Paul site was changed by the operator after a discussion of it with MPCA staff. This was not a requirement, and the operator made the change voluntarily. The perimeter tile now discharges to a vegetated buffer area on the surface. It actually rarely discharges water. It should be remembered that, as a component of a modern, poured concrete manure storage pit constructed according to MPCA standards, a perimeter tile exists to lower the seasonal groundwater table around the pit to relieve hydraulic pressure on it. Any water draining from such tile would be expected to be non-contact ground water under typical operational conditions and should not be contaminated by leakage from the pit, and thus, no permit is required.

Comment 9-10: According to the EIS, an HPP member has spreading fields near the Chippewa River but is complying with setbacks. The EIS also states the need for precautions to protect the river from contaminated runoff. This facility’s permits should be revised to be very clear about the appropriate setbacks and the prohibition of manure application within them, and to require precautions to control contaminated runoff to the river.

Response: The comment is noted. One of the functions of the EIS is to collect information to be used in evaluating final permit conditions. The MPCA during its evaluation of the HPP facilities will utilize the data contained in the EIS to make final permit decisions including setbacks and proper land application techniques in sensitive areas.

Comment 9-11: The EIS concludes that action by Minnesota [to limit antibiotic use at feedlots] may be illegal and likely would be ineffective. However, other states are contemplating such actions, and the McDonald’s Corporation recently decided to limit use of antibiotics among its meat suppliers. The European Union has banned some growth promoters and will phase out others by 2006. Commenter previously requested a study of pathogen and antibiotic dispersal from feedlots in the area, and reiterates that request now.

Response: This is not a conclusion of the HHP EIS analysis. It is a conclusion of the GEIS, and was cited as such on page 134. The HPP EIS does not opine on whether this conclusion is valid, but merely cites it as a statement made by others that may bear on the ultimate resolution of the issue. The HPP EIS’s conclusion, based on the available evidence, is that the contribution of the HPP project to the problem of antibiotic resistance is “…probably not significant on an individual basis…” and that elimination of antibiotic use at HPP facilities “…will not eliminate the problem…”, a conclusion the MPCA continues to stand behind.

Moreover, it is not exactly true that “other states are contemplating such actions.” When asked to elaborate on this statement, commenter referred MPCA to information on the actions of three states in connection with this issue. As it turns out, an Arkansas legislative committee recently killed a bill that would have banned all use of antibiotics at feedlots (including therapeutic use) and added a surcharge on all sales of feed containing antibiotics used in the state; the California Senate and a Maryland House Committee have approved bills that would require tracking the use of antibiotics at feedlots and make the resulting information available to the public. In sum, no states of which the MPCA is aware actually have taken any steps to limit or otherwise regulate the use of antibiotics at feedlots. Two states are, however, planning to track use, which is the very thing recommended by the GEIS in the above citation, as noted in the HHP EIS on page 134.
The HHP EIS also has already noted (on page 66, again citing to the GEIS) that the European Union has banned some antibiotic use and has proposed phasing out others by 2006. This is not new information. Nor is it correct to imply that it is the same thing for one U.S. state among 50 to unilaterally take such an action as it is for the European Union, a confederation of sovereign nations whose economy is collectively much larger and more diversified than any single American state.

The McDonald’s Corporation is a private entity, not a government regulatory authority. Any actions on its part to limit the use of antibiotics in the meat it sells is not an indication of regulatory trends, but merely additional evidence of what the HHP EIS already makes clear that antibiotic resistance is a real issue that a growing scientific and regulatory consensus says must be addressed, as well as an indication that the open market may be responding.

Finally, MPCA records indicate that commenter’s request for field studies was grounded in a concern, expressed during a meeting with MPCA staff on July 10, 2000, that MPCA’s stated intention to base the EIS’s ground-water impact assessment on studies of available literature and regional data would result in an insufficient assessment. The MPCA staff responded to this concern in a letter dated July 25, 2000, in which the MPCA staff expressed the view that field studies of the type being asked for would be quite complex, costly, and time consuming, and would not be needed (nor required by law) for an adequate EIS. Instead, the limited geoprobeing at several HPP sites coupled with reviews of literature and available regional data would support an adequate assessment of the potential for environmental impacts. The MPCA staff remains convinced that this is the case.

Comment 9-12: The feed additive data in Table 2-2 appears dated, so HPP members should be required to provide current information. The feed should be tested to confirm its antibiotic constituents.

Response: The EIS was written over a period of time and the data gathered during that period. The table in the EIS contains the latest information available at the time of publication. Although this is sufficient for EIS purposes, MPCA, through its EIS consultant, revisited the issue of feed additive use with HPP members and found that two additional additives are now used at the farrowing facility. In addition, Zeltwanger, Nohl, and Schaefer have ceased all use of feed additives. Zeltwanger ceased use because he is retiring from the feedlot business and now sells his HPP shares on the open market. The other two ceased use because they now are vaccinating their hogs upon arrival. Table 2-2 has been updated to reflect these changes and is attached for public review. (Attachment B)

It is not feasible or necessary to go back and test all feed due to cost and time constraints. The updated table is regarded as sufficient information regarding this issue.

Comment 9-13: The CAM should have been placed at the south property line, and CAM monitoring should have been performed at the other HPP sites in addition to the farrowing site.

Response: While the EIS does contain a comparison of monitored data with modeled predictions of air pollutant dispersion, a CAM was placed at the farrowing site, not for EIS purposes, but to provide some assurance that allowing that site to move ahead with operations pending the court decision would not endanger air quality. CAM placement at that time was based on availability of electricity to power the equipment, prevailing winds, and barn exhaust direction. The intent was to place it in the most likely path of the majority of site emissions. It was not known until about a year ago (some time after the CAM had been removed and deployed elsewhere) that the nursery barn was the source of most of the site emissions, nor that the fence line immediately south of this barn would be the one most impacted. Resituating the
CAM based on this new knowledge would not have added anything to the EIS; we relied on modeling to assess the air impacts, not the CAM data. For these reasons, monitoring at the other sites would similarly have added little value to the EIS, but would have been a significant expense.

**Comment 9-14:** The EIS notes the potential for air quality standard violations at the farrowing and Charles sites. Commenter opposes the use of variances or road way relocation as means to resolve this potential. Biofilters or anaerobic digesters should be used instead.

**Response:** None required.

**Comment 9-15:** The EIS discussion of airborne particulates does not discuss a recent Zahn study on the subject. The EIS should also have included the EPA analysis of a chicken facility in Ohio that was sued by EPA for failure to have a Title V Air Permit.

**Response:** Commenter provides no citation to the referenced study by Zahn, and we are unaware of a publication written by Dr. Zahn addressing the emission of PM_{2.5} PM_{10} particulates (Particulate Matter less than 2.5 um in size and Particulate Matter less than 10 um in size) from livestock facilities. The Zahn literature we are familiar with is largely concerned with feedlot odor measurement and management. In any case, poultry and swine facilities are not equivalent in terms of particulates generated. The facility in Ohio is significantly larger than the HPP sites and, again, poultry facilities generate more particulates than a swine facility because poultry operations are very dry and birds have more dust associated with them. There is little reason to suspect that an analysis conducted for a poultry facility would add value to an EIS on a hog project.

**Comment 9-16:** The draft EIS acknowledges that the odor analysis was inadequate due to cost-cutting requirements imposed by EQB. The EIS did not compare individual odorous gas levels to benchmarks for health impact assessment purposes because the individual gas determinations were combined into a single value for modeling purposes, in order to save money. However, the individual gases were determined first, then combined. Why were the individual determinations not used for health impact assessment?

**Response:** The Draft EIS does not acknowledge an inadequate analysis of odors. The Draft EIS only indicates that research examining the relationship between trace atmospheric concentrations of individual Volatile Odorous Organic Compound (VOOCs) measured at HPP facilities and human health was not performed as part of the EIS. And, even had individual VOOCs been modeled by CALPUFF, there would still have been little contribution to improving the understanding of the relationship between individual chemicals and odor-induced health effects.

In the protocol we followed, samples of air were drawn through multi-bed adsorption tubes. In the laboratory, the concentrations of individual VOOCs in the air samples were determined by thermal desorption and gas chromatography. The VOOC concentrations were added together to yield the tVOOC concentration for the air sample. This tVOOC concentration was used to calculate the tVOOC emission rate from a livestock barn and the downwind atmospheric tVOOC concentration. The lab work was performed by a subcontractor to the EIS air consultant at an out-of-state location.

The measured individual gas-phase concentrations of VOOCs that have a health guideline or standard (see Table 4-81) were less than the atmospheric concentrations reported by Zahn *et al.* (1997). In other words, the measured atmospheric concentrations of acetic acid, n-propanoic acid, phenol, and *para*-cresol presented in Table 4-81 are greater than the in-barn gas-phase concentrations observed for the sampled
Hancock Pro Pork Hog Feedlot Project Responses to Comments on the Pope and Stevens Counties, Minnesota Environmental Assessment Worksheet

HHP barns. Thus, the potential for human health effects from the atmospheric exposure of individual VOOCs emitted by the HHP sites is even less than that suggested by the atmospheric concentrations provided in Table 4-81. Retrieving the individual concentrations, at the expense of additional time and effort, and comparing them with benchmarks, would thus be only an academic exercise and would not further the understanding of potential impacts from the HHP sites.

Comment 9-17: What assumptions were made in modeling VOOC dispersion, and were they conservative? Did the analysis capture the potential for serious odor impacts that might be associated with high heat and humidity?

Response: As indicated above (Comment 9-16), the individual VOOC concentrations were added together to yield the tVOOC concentration for the air sample.

A fundamental assumption in the air quality modeling was that the individual VOOCs behave similarly in the atmosphere while being transported downwind, i.e., they were assumed to behave as conservative or inert gases. This is not actually the case. Other work by the subcontractor (Zahn et al. 1997) observed the selective removal of the individual VOOCs with higher molecular weights from the atmosphere. The higher molecular weight VOOCs tend to be more odorous. Thus, by treating the tVOOC as a conservative compound, the air quality modeling probably overestimated tVOOC concentrations downwind of the modeled HHP sites, and was, therefore, a conservative evaluation.

The air quality modeling used on-site weather data (July 30, 1999, through September 30, 2000) to supply wind speeds and wind directions. Air temperatures, atmospheric stability classes, and rural mixing heights were obtained from the Minneapolis and Chanhassen weather stations. Thus, about five months of summer weather data were used in estimating downwind hydrogen sulfide, ammonia, and tVOOC concentrations. If the maximum property-line or nearest-neighbor hydrogen sulfide, ammonia, or tVOOC concentrations were associated with summer weather conditions not captured in the five months of monitored weather data, then the modeling would not have captured the worse-case conditions. However, for the monitored weather conditions, the maximum property-line and nearest-neighbors concentration were in fact captured subject to the constraints of any air quality model.

Because the hydrogen sulfide and tVOOC emission rates for the HHP barns were actually measured on site, any humidity effects on the emission of the compounds from the manure pits and elsewhere were implicitly incorporated into the emission measurement. The Zahn correlation provides an empirical relationship between the gas-phase tVOOC concentration and the measured odor intensity. Development of the Zahn correlation did not include humidity as an independent variable. However, no correlations are known to exist that define odor intensity as a function of humidity.

Comment 9-18: Were the assumptions made in modeling cumulative hydrogen sulfide and ammonia dispersion conservative?

Response: As with all modeling studies, a number of assumptions were made, some of which were “conservative,” e.g., led to overestimation of concentrations, and some of which led to underestimation of concentrations. The skill of the modeler comes into play in balancing such counteracting assumptions, and is typical of regulatory modeling. Regulatory modeling procedures are geared to err on the side of over prediction. Some of the model assumptions that lead to overestimation include the assumption that all barns emit at their maximum rate at all times, that modeled gases do not react and decompose during transport, and that modeled gases remain in the air and are not removed through deposition.
As a conservative assumption, the regional air quality modeling assumed that hydrogen sulfide and ammonia were conservative chemicals. This is not actually the case. Both are subject to atmospheric chemical reactions and to depositional processes.

The analysis of these pollutants was, thus, appropriately conservative.

Comment 9-19: The odor analysis should have involved more extensive direct reading of odors, including field olfactometers and other technology.

Response: The MPCA rejected the notion of using olfactometry in the HHP analysis for three reasons. First, olfactometry is not precise in that it depends on the subjective response of a panel of people whose perceptions may vary from day to day and from time to time. Second, there is no standard against which to judge whether olfactometry results are acceptable. And third, conducting olfactometry at a large number of sites, such as at the HHP sites, is time-consuming and expensive and the MPCA did not have a budget to conduct this level of sampling.

Field olfactometers and related technology were not considered for use in large part because none of the proposals submitted by consultants proposed their use. Such techniques are imprecise and would require numerous measurement replicates to provide an accurate picture of odor intensity. Because of the requirement for numerous replicates, the use of such methods would have been time-consuming and expensive.

A fundamental weakness with using field olfactometers and similar technology is that such measurements of odor intensity by definition represent receptors (e.g., the location of a nearest neighbor) and can only be made at one location per sampling event. Thus, despite spending the time and resources to collect statistically-significant field measurements, the receptor-based approach will always subject to the complaint that the downwind field measurement was not made at the right place or when the atmospheric conditions created the worse odor intensity, i.e., the “you should have been here this morning” complaint. Another disadvantage of this kind of measurement is that numerous measurements must be performed at numerous locations if an accurate EIS impact assessment is to be obtained. This would be a laborious process that would clearly be extremely costly and time consuming. However, even with this laborious approach, it would be difficult to prove that the worst case was actually captured.

Instead, a chemistry-based source-characterization approach was used. The measured chemical emission rates were used to estimate downwind chemical concentrations via air quality modeling and monitored weather conditions. The maximum receptor concentration for hundreds of receptors can be estimated by a single CALPUFF run. The downwind tVOOC concentration was converted to an odor intensity index by the Zahn correlation. The employed approach offers the precision of Gas Chromatography/Mass Spectrometry analysis, provides the accuracy of EPA-approved air quality modeling, and eliminates the “you should have been here this morning” complaint.

Comment 9-20: Were follow-up inspections performed to assure that deficiencies in record keeping had been corrected?

Response: Yes. The operators have been informed of their responsibilities in this area and are expected to comply in the future.

Comment 9-21: Feedlot permits should contain adequate reporting and record keeping requirements to assure that setbacks are followed and shallow ground water is protected.
Response: Commenter’s opinion is noted. Record keeping requirements already exist in the rules. Under new federal rules annual reporting is required of NPDES feedlots. The farrowing site is subject to those requirements.

Comment 9-22: The EIS states that European studies identify that wildlife can be infected with disease by manure spreading, but says there is no evidence of that happening in this case. However, no actual sampling was done in the area to confirm this. In light of the European findings, the EIS should say that the possibility of wildlife infection exists but no study was done on the possibility.

Response: The budget for this EIS did not allow for actual wildlife sampling. On the other hand, it is not accurate to say that there was no study of the issue. The EIS (page 124) analyzes this issue to the extent that available evidence indicates is appropriate.

Comment 9-23: What are the endocrine disruptors referred to in the EIS as impacting minnows in Nebraska, and how does the EIS come to the conclusion that similar chemicals are not being used at HPP-facilities?

Response: The article does not identify the chemicals in question, identifying them only as “masculinizing” or “feminizing” compounds. The article’s primary thrust was a discussion of the possible endocrine disrupting actions of growth hormones fed to beef cattle. All known feed additives used at HPP facilities are listed in the updated Table 2-2 (Attachment B), and none of the listed feed additives are known to act as hormones. They are all described in the information available to us as antibiotic compounds, whose growth promotion action is not completely clear, but thought to work by allowing animals to divert most of their physiological resources to weight gain rather than to fighting off disease. The MPCA has found nothing in the literature to indicate that antibiotics act as endocrine disruptors. Instead, the literature implicates them in the development of antibiotic resistant pathogens. Feed growth hormones, on the other hand, are thought to work by actively shutting down or greatly reducing certain routine bodily processes (such as sexual activity) in favor of weight gain. Based on these considerations and the information in the table, the EIS concluded that “no chemicals are in use at HPP sites that are known to act as endocrine disruptors.”

Comment 9-24: The MPCA found during the EIS process that there were some problems with animal mortality management at some HPP feedlots. Are operators in compliance now? BAH requirements should be incorporated into the feedlot permits and that they should be enforced.

Response: Permit decisions and coordination with BAH on animal mortality management is outside the EIS process. The information in the EIS process will guide these efforts. Having said that, the MPCA understands, as stated in the EIS, that HPP operators are in compliance or have been counseled by BAH, which has conducted or will conduct follow-up inspections, and they soon will be in compliance. The farrowing site, where mortalities are incinerated, is in compliance with the appropriate rules for incinerators as confirmed by MPCA inspection.


Comment 10-1: Commenter has been to public meetings at which HPP stated that there would be no problems from its operations. Now that it is clear that almost half of the facilities do in fact have problems, it seems that either HPP does not consider the environment important or does not think MPCA will enforce its regulations.
Response: No response required.


Comment 11-1: Commenters are concerned about the Chippewa River, area air quality, and long-term health and environmental effects. The MPCA should monitor and follow through on all environmental components.

Response: See responses 9-18 and 12-1.


Comment 12-1: HPP is a serious threat to the Chippewa River, which has exhibited greatly elevated fecal coliform levels. The facilities that apply manure to granular soils need to be controlled so as to minimize this threat.

Response: It is unclear why the commenter believes HPP is a “serious threat” to the Chippewa River. Only one HPP operator (Solvie) has spreading fields in the vicinity of this river, and, as noted on page 78 of the EIS, the spreading acres do not include the river floodplain. Moreover, Solvie is aware of the setback and agronomic rate application requirements on the rules, and states that he abides by them. Appropriate controls are administered by means of MPCA and county review of the appropriate manure management plans, and inspections as indicated to ensure that proper precautions are employed by HPP members.

Comment 12-2: Commenters report being physically and financially threatened for speaking out about their concerns.

Response: See response 6-1.


Comment 13-1: Three of the four facilities found to pose ground water contamination potential are under 1,000 AU, and thus exempt from a citizen review process in the future. The rules providing for this must be changed.

Response: See responses 6-2, 6-3, and 9-1.


Comment 14-1: How will MPCA assure that manure application will not impact the Chippewa River and shallow wells?

Response: See responses 6-6, 9-2, 9-6, and 12-1.
15. **Comments by Polly L. McCormack, MD. Letter dated June 25, 2003.**

**Comment 15-1:** Commenter is concerned that ground water can be polluted by feedlots of less than 1,000 AU, which are not subject to environmental review.

**Response:** See responses 6-2, 6-3, 6-6, and 9-1.

**Comment 15-2:** Commenter supports spring manure application on granular soils. If there are measures that minimize impacts from fall application, the public should be given the opportunity to comment on them.

**Response:** See response 6-6.

**Comment 15-3:** Liquid manure application should be banned near the Chippewa River.

**Response:** See response 12-1.

**Comment 15-4:** Commenter is concerned about well contamination, and urges continued testing of deep and shallow wells.

**Response:** See response 9-6. The regular testing of private drinking water wells is recommended by the Minnesota Department of Health.


**Comment 16-1:** There seems to be pressure to free the hog industry from all standards of good citizenship, which can only lead to community economic decline. The state government needs to see the EIS results and “better understand what they have created with their recent political activities.”

**Response:** No response required.

17. **Comments by Helen T. Steele. Letter dated June 24, 2003.**

**Comment 17-1:** Any manure that is land applied must be monitored to prevent contamination in the Chippewa River.

**Response:** The land application requirements provided in the feedlot rules were evaluated and established to be protective of surface waters and ground water. These requirements were established based on research information and in-field application of research information to determine if the appropriate rates were achievable. In-field monitoring of all manure is not practical. See also response 12-1.

**Comment 17-2:** Does MPCA have sufficient staff to research the decisions it makes and to adequately police the feedlots it permits?

**Response:** The MPCA feedlot program is staffed as provided by funding by the State Legislature. The MPCA has established a program with delegated counties to permit and inspect feedlots with the MPCA focusing on the feedlots with greater than 1,000 animal units or located in counties without a county feedlot officer.

**Comment 18-1:** Is the air model used in this EIS capable of identifying differences in odor levels at close ranges, or does it only define a larger interval?

**Response:** In an air dispersion modeling study, receptor location and density are geared to find the maximum concentrations and to understand the gradient in concentrations. Air dispersion modeling staff has found from years of experience that for source-to-property line distances such as those at the HHP site, receptors located approximately every 25 meters is sufficient to capture the maximum concentration and the gradient in concentrations.

**Comment 18-2:** Does confidence in the model increase or decrease with distance from the source?

**Response:** Air dispersion models typically perform best at intermediate distances from the source. Within a few meters of the source, e.g., in the building cavity area, the model uncertainty is thought to be higher than farther downwind. Likewise, beyond one hour travel distance downwind the model predictions are also considered to be more uncertain. The one hour travel distance depends on the wind speed and ranges from about 3 kilometers for a very light wind up to 30 kilometers when winds are stronger.

**Comment 18-3:** How does a non-animal space within a source affect model results?

**Response:** Office space within the feedlot barn complex does not affect the emissions calculations. The fact that a building is larger because of the presence of office space does affect the dispersion calculations in the building wake region, e.g., a smaller building without office space would present a smaller profile to the wind (for some wind angles) and would create less turbulence.

**Comment 18-4:** Can the model predict the effect of mitigation on source emissions?

**Response:** The modeling analysis by itself does not account for mitigation measures. Other measurements are required to determine the effectiveness of a mitigation measure, and once determined, the reduced emissions from the implementation of the mitigation can be simulated in the model.


**Comment 19-1:** Commenter has seldom experienced odors from the HPP barns, and does not object to that.

**Response:** None required.

20. **Comments by Mark Erdahl. Letter received June 26, 2003.**

**Comment 20-1:** Commenter’s employment has taken him to the HPP farrowing site numerous times, and he has found it to be a well run operation.

**Response:** None required.
LATE COMMENTERS

Comment letters from the following were received after the close of the public notice period and will therefore not receive individual responses. The comment period extended from May 12, 2003, to June 26, 2003, a total of 45 days rather than the usual 30 days. Many of the issues raised in the late letters were addressed in responses to other commenters, including responses 2-6, 2-13, 2-14, 3-6, 5-1, 5-6, 3-7, 6-2, 6-3, 9-1, 9-5, 9-6, 9-7, 9-11, 9-13, 9-14, 9-23, 12-1, and 19-1.

Ivalene Cooley (received June 27, 2003 – one day late).
Norman and DiAnn Beyer (received June 27, 2003 – one day late).
David Preissler, Minnesota Pork Producers Association (received via email and unsigned July 9, 2003 - two weeks late).
Orrin Wilson (received July 9, 2003 - two weeks late).