LOWER SIOUX INDIAN COMMUNITY HOUSING
DEPARTMENT TRIP REPORT
Assessment of Mold and Moisture Conditions

Final Report

Date:
June 27-30, 2004

Prepared for:
U.S. Department of Housing & Urban Development
Office of Native American Programs

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BACKGROUND INFORMATION

The Lower Sioux Indian Community (LSIC) is located in Redwood County, in Minnesota. The average annual precipitation is 28 inches. The average annual snowfall is 45 inches. The average annual maximum temperature is 92°F and the average annual minimum temperature is 17°F. Approximately 400 Native Americans reside in about 120 households in the LSIC. Of the 20 HUD Section 18 Act units, 26 have been conveyed to homeownership under Mutual Help and four are rental units.

The assessment team responded to a request from the Eastern Woodland Office of Native American Programs to assess site and housing conditions contributing to mold and moisture problems at the LSIC. Karen Bogan, Housing Consultant, requested technical assistance to address mold and moisture conditions. The assessment team visited ten homes and the Social Services Building. Five homes were split level with wooden foundations. Four homes were ranch style, mostly modular. One home was a two-story on a block foundation. All homes were heated with liquid propane or natural gas central heating. The homes ranged in age from seven to fifty years. The Social Services Building was over 100 years old and on the National Register of Historic Places. Nine homes had experienced some basement flooding due to recent heavy rains.

Day 1: Sunday: June 27, 2004

Sunday was a travel day.

Day 2: Monday: June 28, 2004

The assessment team arrived at the office of the LSIC HO on Monday morning to meet with Karen Bogan, Rita Demats, and Elvis Reamann, Facilities Director. At the meeting,
PART I

LOWER SIOUX INDIAN COMMUNITY HOUSING DEPARTMENT TRIP REPORT

INTRODUCTION

Michelle Rook and Donald Fournier from the Building Research Council (BRC) at the University of Illinois Urbana-Champaign conducted a site visit at the Lower Sioux Indian Community Housing Department (LSICHD). Lower Sioux Housing administers the housing program for the Lower Sioux Indian Community of Minnesota. The site visit provided technical assistance to the Housing Department in assessing mold and moisture conditions in housing units. This report summarizes activities and issues addressed while on site. A detailed analysis of findings and recommendations is found in PART II: Lower Sioux Indian Community Housing Department Technical Housing Assessment Report: Examining Mold and Moisture Conditions of Homes in the Lower Sioux Indian Community.

BACKGROUND INFORMATION

The Lower Sioux Indian Community (LSIC) is located in Redwood County, in Minnesota. The average annual precipitation is 28 inches. The average annual snowfall is 45 inches. The average annual maximum temperature is 92° F and the average annual minimum temperature is -17° F. Approximately 409 Native Americans reside in about 126 households in the LSIC. Of the 30 HUD '37 Act units, 26 have been conveyed to homeownership under Mutual Help and four are rental units.

The assessment team responded to a request from the Eastern/Woodland Office of Native American Programs to assess site and housing conditions contributing to mold and moisture problems at the LSIC. Karen Bogan, Housing Consultant, requested technical assistance to address mold and moisture conditions. The assessment team visited ten homes and the Social Services Building. Five homes were split level with wooden foundations. Four homes were ranch style, mostly modular. One home was two-story on a block foundation. All homes were heated with liquid propane or natural gas central heating. The homes ranged in age from seven to fifty years. The Social Services Building was over 100 years old and on the National Register of Historic Places. Nine homes had experienced some basement flooding due to recent heavy rains.

Day 1: Sunday: June 27, 2004

Sunday was a travel day.

Day 2: Monday: June 28, 2004

The assessment team arrived at the office on the LSICHD on Monday morning to meet with Karen Bogan, Rita Daniels, and Dion Prescott, Facilities Director. At the meeting,
the group discussed the day’s activities, outlined the team’s role while on the reservation, and addressed the Housing Department’s issues. The housing staff presented the specific mold and moisture issues that the Housing Department and Facilities had been handling. Of specific concern were the recent heavy rains and how they had contributed to mold and moisture conditions in the basements. Many homes had wooden basements and were experiencing water intrusion from both around the foundation and through basement windows.

The Housing Department selected the properties to be inspected and Rita Daniels and Dion Prescott coordinated the logistics for the site visit. Following the meeting, the assessment team, guided by Dion Prescott, inspected two homes and the Social Services Building in the Community.

**Day 3: Tuesday, June 29, 2004**

In the morning, the assessment team met with Rita Daniels and proceeded to inspect six homes.

**Day 4: Wednesday, June 30, 2004**

On Wednesday morning, the assessment team met with Dion Prescott and inspected two more homes. In the afternoon, the team met with Dion Prescott to discuss findings and strategies for solutions.

**Day 5: Thursday, July 1, 2004**

Thursday was a travel day.

**FINDINGS**

An overview of findings and recommendations from the site visit follows. *PART II: Lower Sioux Indian Community Housing Department Technical Assessment Report* provides detailed discussion and analysis of the findings.

**Lower Sioux Indian Community**

Principal findings from the site inspections include:

1. All but one home had rainwater intrusion that led to water damage, mold on the basement walls, and wet carpeting. The two primary contributing conditions were poor drainage and site conditions. Past plumbing leaks and moisture problems had also led to mold infestations.

2. Three homes had mold contamination from condensation on windows in the winter. One had failed window frames and sills due to condensation.
3. Four homes had mold and/or water damage in the bathrooms due to either non-operational ventilation fans or failed caulking around fixtures.

4. Only one inspected home had moisture problems or mold due to cold spots or thermal bridging in wall or ceilings.

NEW CONSTRUCTION AND FUTURE HOUSING DEPARTMENT ACTIONS

The assessment team recommends the Housing Department consider the following in existing and future housing projects:

1. Install ducted ventilation fans in all new home bathrooms and kitchens.

2. Since the area appears to have high water tables and is subject to severe rain events, build new homes with particular care to avoid basement flooding problems. This includes proper site drainage, full gutters with long leaders (6-8 feet), and functional sump pumps. Do not finish basements as they may experience a flooding event.

3. Develop policies and procedures for handling mold and moisture problems in tribal homes.

4. Work with the Tribal Attorney to develop an Addendum to the standard lease agreement that requires the tenant to take steps to reduce the potential for mold growth in their unit. Attachment 1 is a copy of the Addendum to Lease Agreement under development by another Tribe. This document not only provides some level of protection for the occupants, but also an excellent educational tool that lists tenant actions or steps to discourage mold growth and promote a healthy environment.

5. Include a ‘Notice, Disclosure and Disclaimer’ statement addressing mold conditions in current tenants lease agreement packet. With minor editing by the Housing Director and Tribal Attorney, this document can provide valuable information to potential tenants. See Attachment 2.

The Housing Department is taking positive action to develop a team effort with the tenants to prevent mold. Adding both the Addendum to Lease Agreement and Notice, Disclosure and Disclaimer documents to Tenant Lease Agreements could provide valuable information on mold background, tenant responsibilities, and practices that contribute to a healthy indoor environment. Preventing mold requires a team effort among the housing department, building maintenance, and occupants. These attached documents reinforce the important role occupants play in maintaining healthy, safe home environments.
PROGRAMMATIC RECOMMENDATIONS

Addressing mold and moisture problems presents a two-phase challenge to develop a prompt and effective delivery system:

- Develop a partnership between the housing department and residents.
- Develop a two-part training program to:
  - Train maintenance staff to implement technical recommendations.
  - Train residents on their roles and responsibilities as homeowners and tenants.

The Housing Department has already taken excellent action steps to create the partnership. Additional steps to supplement their program could include formalized methods for addressing mold problems and maintenance issues as they occur. For example:

1. Mandatory attendance at annual homeowner/tenant clinics as part of the annual recertification process. At these clinics, provide instruction on home maintenance issues, such as identifying and repairing leaks, using exhaust fans and maintaining gutters.

2. During the annual recertification process, ask occupants to complete a survey based on Housing Quality Standards (HQS) with additional questions on mold and moisture conditions in their homes. Completing the survey further engages residents in their own home maintenance. Furthermore, the survey responses provide additional information to the housing authority on unreported problems, particularly leaks and inoperable fans that might contribute to an unsafe, unhealthy home environment.

The following websites and references provide further information on mold remediation and testing:

Indoor Air Quality:

Ball State University Indoor Environment Notebook - General resource on a number of topics related to indoor air quality.
http://publish.bsu.edu/ien/archives/archive_list.htm (will open a new browser window)

Mold:

EPA - Mold Remediation in Schools and Commercial Buildings
http://www.epa.gov/iaq/molds/index.html (will open a new browser window)

New York City Department of Health Bureau of Environmental & Occupational Disease Epidemiology - Guidelines on Assessment and
Remediation of Fungi in Indoor Environments
http://www.ci.nyc.ny.us/html/doh/html/epi/moldrpt1.html (will open a new browser window)

References:

Guidelines on Assessment and Remediation of Fungi in Indoor Environments, Bemidji Area Indian Health Service Office of Environmental Health and Engineering, Environmental Health Services Section.


Attachment I
Attachment II

The Addendum to Lease Agreement of ____________ attached to and made part of the Lease Agreement dated ____________, by and between ("Landlord") of and ("Tenant") and related to Unit # ____________,

WHEREAS, it is acknowledged between Landlord and Tenant that apartments in areas that experience high humidity and wet weather may, under certain circumstances, experience mold growth and,

WHEREAS, Landlord and Tenant agree that the Tenant should use due diligence in attempting to ameliorate the possible environment for mold growth by preventing excessive humidity inside the unit area and,

WHEREAS, the Tenant agrees to contribute to these efforts and the goal of preventing mold growth in the unit by affirmatively accepting the following obligation;

NOW THEREFORE, Landlord and Tenant agree as follows:

1. Tenant agrees to open windows, as temperature and weather conditions permit, to allow an exchange of air and permit the introduction of sunlight throughout the unit.

2. Tenant agrees to regularly maintain the unit including but not exclusive of, vacuuming, mopping, dusting, and using typical household cleaners.

3. Tenant agrees to maintain general temperatures within the unit between 65°F and 72°F, as well as maintain general relative humidity between 30 and 50% within the unit at all times. Further, Tenant agrees that if Tenant is having trouble maintaining these indoor environmental conditions that Tenant will promptly notify Landlord so that repairs can be made to maintain these indoor air quality standards.

4. Tenant agrees to as soon as reasonably possible, wipe down and dry areas that accumulate visible moisture like, counter tops, windows, window sills, bathroom walls, shower areas, etc.

5. Tenant agrees to use pre-installed bathroom fans when showering or bathing in such a way that excess moisture is vented from the bathroom.

6. Tenant agrees to leave bathroom doors open until all moisture on mirrors and bathroom walls/surfaces has dissipated.

7. Tenant agrees to clean laundry and other wet upholstered items as soon as possible after they have become wet.

8. Tenant agrees to use exhaust fans in kitchens when cooking or while dishwashers are on dry cycles to vent excess moisture from kitchens.

9. Tenant agrees to limit house plants to a reasonable number, do not over water house plants and clean up spills from leaky watering.

Building Research Council
Exhibit B
Exhibit "A" to Lease Agreement

Joseph E. Quandt

This Addendum to Lease Agreement dated this ______ of __________________, 20___ is attached to and made part of the Lease Agreement dated __________________, 20___ by and between ("Landlord") of and ____________________ ("Tenant") and relates to Unit #______.

WHEREAS, it is acknowledged between Landlord and Tenant that apartments in areas that experience high humidity and wet weather may, under certain circumstances, experience mold growth; and,

WHEREAS, Landlord and Tenant agree that the Tenant should use due diligence in attempting to ameliorate the possible environment for mold growth by preventing excessive humidity inside the unit area; and,

WHEREAS, the Tenant agrees to contribute to these efforts and the goal of preventing mold growth in the unit by affirmatively accepting the following obligation:

NOW THEREFORE, Landlord and Tenant agree as follows:

1. Tenant agrees to open windows, as temperature and weather conditions permit, to allow an exchange of air and permit the introduction of sunlight throughout the unit.

2. Tenant agrees to regularly maintain the unit including but not exclusive of, vacuuming, mopping, dusting, and using typical household cleaners.

3. Tenant agrees to maintain general temperatures within the unit between 65°F and 78°F as well as maintain general relative humidity between 30 and 50% within the unit at all times. Further, Tenant agrees that if Tenant is having trouble maintaining these indoor ambient conditions that Tenant will promptly notify Landlord so that repairs can be made to maintain these indoor air quality standards.

4. Tenant agrees to as soon as reasonably possible, wipe down and dry areas that accumulate visible moisture like counter tops, windows, window sills, bathroom walls, shower areas, etc.

5. Tenant agrees to use pre-installed bathroom fans when showering or bathing in such a way that excess moisture is vented from the bathroom.

6. Tenant agrees to leave bathroom doors open until all moisture on mirrors and bathroom walls/tile surfaces has dissipated.

7. Tenant agrees to clean laundry and other wet upholstered items as soon as possible after they have become wet.

8. Tenant agrees to use exhaust fans in kitchens when cooking or while dishwashers are on dry cycles to vent excess moisture from kitchens.

9. Tenant agrees to limit house plants to a reasonable number, do not over water house plants and clean up spills from over watering.

1. Mr. Quandt gratefully acknowledges the assistance of Julie A. Harrison in the compilation of written materials for this program.
10. Tenant agrees to ensure that any clothes dryer vent is property connected and clear of obstructions. Also, clean the lint screen after every use. When washing clothes in warm or hot water, watch to make sure that condensation is not built up within the washer and dryer closet. If condensation does gather, leave the closet door open after every use.

11. Tenant agrees to when showering, be sure to keep the shower curtain inside the tub or fully close the shower doors.

12. Tenant agrees to periodically clean and dry the walls around the bathtub and shower using a common reliable household cleaner.

13. Tenant agrees to not allow damp or moist stacks of clothes or other cloth material to lay in piles.

14. Tenant agrees to immediately report to the management office, any evidence of a water leak or excess moisture in the unit, storage room, garage or any common area.

15. Tenant agrees to immediately report to management any evidence of mold or mildew like growth that cannot be removed by simply applying a common reliable household cleaner.

16. Tenant agrees to look for leaks in washing machine hoses and discharge lines especially if the leak is large enough for water to saturate trim or drywall.

17. Tenant agrees to immediately report to management, any failure or malfunction with the heating ventilation or your air conditioning system.

18. Tenant agrees to immediately report to management any inoperable windows.

19. Tenant agrees to not block or cover any heating ventilation or air conditioning supply, diffusers and/or return grills in the unit.

20. Tenant agrees to follow the house pet policy and immediately clean up any pet accidents.

21. Tenant agrees to recognize that unreasonable and/or humidifier use can contribute to conditions favorable for mold growth.

22. Tenant agrees to recognize that personal air cleaners have been linked to unacceptable amounts of ozone in indoor environments and that the use of personal air cleaners is discouraged as ozone can enhance the condition and environment for excess mold growth.

Tenant agrees that Tenant shall be responsible for damage to the unit and the Tenant's property as well as any injury to the Tenant or anyone residing in the unit with Tenant for any period of time which results from the Tenant's failure to comply with this exhibit/addendum. A default under the terms of this Addendum/Exhibit shall be deemed a material default under the terms of the lease and Landlord shall be entitled to exercise all rights and remedies at law or in equity.

Except as specifically stated herein, all other terms and conditions of the lease shall remain unchanged. In the event of any conflict between the terms of this Addendum/Exhibit and the terms of the lease, the terms of this Addendum/Exhibit shall control. Any term that is capitalized but not defined in this Addendum/Exhibit that is capitalized and
defined in the Lease shall have the same meaning for the purposes of this Addendum/Exhibit as it has for purposes of the Lease. Tenant understands that if mold is detected in Tenant's unit under certain circumstances, Landlord may, at its discretion, temporarily relocate Tenant to a comparable furnished apartment while the problem is evaluated. This may include Landlord's option to terminate Tenant's Lease. Your signature below indicates your agreement that Landlord may temporarily relocate Tenant to a comparable furnished unit under such circumstances.

Agreed to this ___ day of ___________________, 20__.

Landlord: 

____________________________________________________

Tenant: 

____________________________________________________
NOTICE, DISCLOSURE and DISCLAIMER

What Homeowners Should Know about Mold

Mold. Lately, mold has been in the news. Mold is a type of fungus. It occurs naturally in the environment, and it is necessary for the natural decomposition of plant and other organic material. It spreads by means of microscopic spores borne on the wind, and is found everywhere life can be supported. Residential home construction is not, and cannot be, designed to exclude mold spores. If the growing conditions are right, mold can grow in your home. Most homeowners are familiar with mold growth in the form of bread mold, and mold that may grow on bathroom tile.

In order to grow, mold requires a food source. This might be supplied by items found in the home, such as fabric, carpet or even wallpaper, or by building materials, such as drywall, wood and insulation, to name a few. Also, mold growth requires a temperate climate. The best growth occurs at temperatures between 40 degrees F and 100 degrees F. Finally, mold growth requires moisture. Moisture is the only mold growth factor that can be controlled in a residential setting. By minimizing moisture, a homeowner can reduce or eliminate mold growth.

Moisture in the home can have many causes. Spills, leaks, overflows, condensation, and high humidity are common sources of home moisture. Good housekeeping and home maintenance practices are essential in the effort to prevent or eliminate mold growth. If moisture is allowed to remain on the growth medium, mold can develop within 24 to 48 hours.

Consequences of Mold. All mold is not necessarily harmful, but certain strains of mold have been shown to have adverse health effects in susceptible persons. The most common effects are allergic reactions, including skin irritation, watery eyes, runny nose, coughing, sneezing, congestion, sore throat and headache. Individuals with suppressed immune systems may risk infections. Some experts contend that mold causes serious symptoms and diseases which may even be life threatening. However, experts disagree about the level of mold exposure that may cause health problems, and about the exact nature and extent of the health problems that may be caused by mold. The Center for Disease Control state that a causal link between the presence of toxic mold and serious health conditions has not been proven.

What the Homeowner Can Do. The homeowner can take positive steps to reduce or eliminate the occurrence of mold growth in the home, and thereby minimize any possible adverse effects that may be caused by mold. These steps include the following:

1. Before bringing items into the home, check for signs of mold. Potted plants (roots and soil), furnishing or stored clothing and bedding material, as well as many other household goods, could already contain mold growth.

2. Regular vacuuming and cleaning will help reduce mold levels. Mild bleach solutions and most tile cleaners are effective in eliminating or preventing mold growth.

3. Keep the humidity in the home low. Vent clothes dryers to the outdoors. Ventilate kitchens and bathrooms by opening the window, by using exhaust fans, or by running the
air conditioning to remove excess moisture in the air, and to facilitate evaporation of water from wet surfaces.

4. Promptly clean up spills, condensation and other sources of moisture. Thoroughly dry any wet surfaces or material. Do not let water pool or stand in your home. Promptly replace any materials that cannot be thoroughly dried, such as drywall or insulation.

5. Inspect for leaks on a regular basis. Look for discolorations or wet spots. Repair any leaks promptly. Inspect condensation pans (refrigerators and air conditioners) for mold growth. Take notice of musty odors, and any visible signs of mold.

6. Should mold develop, thoroughly clean the affected area with a mild solution of bleach. First, test to see if the affected material or surface is color safe. Porous materials, such as fabric, upholstery or carpet should be discarded. Should the mold growth be severe, call on the services of a qualified professional cleaner.

**Disclaimer and Waiver**

Whether or not you as a homeowner experience mold growth depends on how you manage and maintain your home. Our responsibility as a homebuilder must be limited to things that we can control. As explained in our written warranty, provided by separate instrument, we will repair or replace defects in our construction (defects defined as a failure to comply with reasonable standards of residential construction) for a period of ____ years. We, the builder, will not be responsible for any damages caused by mold, or by some other agent that may be associated with defects in our construction, to include but not limited to property damage, personal injury, loss of income, emotional distress, death, loss of use, loss of value, and adverse health effects, or any other effects. Any implied warranties, including an implied warranty of workmanlike construction, an implied warranty of habitability, or an implied warranty of fitness for a particular use, are hereby waived and disclaimed.

This notice, disclosure and disclaimer agreement is hereby appended to and made apart of the contract of sale. The consideration for this agreement shall be the same consideration as state in the contract of sale. Should any term or provision of this agreement be ruled invalid or unenforceable by a court of competent jurisdiction, the remainder of this agreement shall nonetheless stand in full force and effect.

I acknowledge receipt of the notice, disclosure and disclaimer agreement. I have carefully read and reviewed its terms, and I agree to its provisions.

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PART II
LOW SIOUX INDIAN COMMUNITY HOUSING DEPARTMENT
TECHNICAL HOUSING ASSESSMENT REPORT

EXAMINING MOLD AND MOISTURE CONDITIONS IN HOMES IN THE LOWER SIOUX INDIAN COMMUNITY

Executive Summary

Introduction

Section 1: Methodology

Section 2: House Descriptions

Section 3: Findings

Section 4: Technical Discussion and Recommendations

Section 5: Discussion of Common Problems

Appendix A: Housing Survey Summary Site Visit Report

Appendix B: Housing Assessment Results
EXECUTIVE SUMMARY

The assessment team inspected ten homes and the Social Services Center for mold and moisture problems, as requested by the Lower Sioux Indian Community Housing Department (LSICHD) that administers the housing program for the Lower Sioux Indian Community in Minnesota. The investigation was performed from June 28th - 30th by Donald Fournier and Michelle Rook of the Building Research Council. The inspection process involved visual assessment of both interior and exterior conditions and resident interviews. Occupants were present at all homes and the interiors were accessible.

Five homes were stick-built split level with wooden basements. Three homes were modular ranch homes, two with a wooden basements and one with a concrete basement. One home was a two-story stick-built over a cement block basement. One home was a stick-built ranch over a wooden basement/crawlspace. All but two inspected homes were 2 inch x 6 inch construction. Homes ranged in age from 7 to 23 years. The homes were heated with propane- or natural gas-fired forced-air furnaces. The Social Services Building was a historic building about 115 years old. It was originally a school and has a stone block foundation and stick built with a dirt floor.

The LSICHD has been active in mold remediation at homes in the community. As a result, LSICHD had remediated prior mold and moisture problems. In general, the repairs have been successful, indicating that the LSICHD has the situation largely under control.

Principal findings include:

1. The most significant problem in all the homes was mold in basements due to water intrusion during heavy rains. This was especially a problem in the split foyer homes as they are set too low in the ground and water enters through basement window(s).

2. Bathroom exhaust fans, present in most homes, were not tested, since problems were not related to bathroom fans, except in one case, and that resulted from a failed fan. Nine of ten kitchen fans vented to the outside and the Social Services Building had no kitchen fan. In two homes, the kitchen fan thru-wall vents had flashing problems.

3. Five homes had fully-functional gutter systems. All other homes had guttering, but some guttering had missing or damaged gutters, downspouts, and/or leaders. As a result, water collected at the foundation, and in some cases, formed distinct drip lines or depressions that extended much of the length of the home beneath the eaves.

4. Six homes and the Social Services Building had significant site drainage problems in addition to the gutter issues. The sites tended to be too flat and /or
sloped toward the home. This was especially a problem with the split foyer homes. Good site drainage helps maintain a dry home.

5. Poor insulation and exterior air leakage over the eaves caused mold growth at the juncture of the exterior walls and ceilings in only one home. Although this is a common problem in northern climates in homes with low pitch roofs and high interior moisture loads, it was good to see that it was not prevalent at LSICHD. This one case may also be the result of not using the bathroom ventilation fan.

6. Several homes had sweating pipes, indicating condensation on the plumbing and, in one case, on the toilet tank in the upstairs bathroom. This condition resulted from high moisture loads in the basements. Also, several homes had caulking failures along the tub at the floor and, in one case, the moisture had penetrated the floor and damaged the sub-flooring which could be seen from the basement below. Damage from previous plumbing leaks and toilet leaks was also evident in several homes.

7. One home had mold growing on the basement walls about two feet above the floor. It was probably caused by a lack of gutters and a failed sump pump allowing water to enter the basement during heavy rains.

8. All the split foyer homes had some water damage and mold due to recent flooding. These homes had site drainage issues and some had guttering problems.

9. Several homes were reported to have had mold around the windows. The LSICHD could address this problem by enlarging the cavity around the windows and adding insulation and/or replacing the windows with higher quality units with better insulating glass and higher R-value sashes.

10. Several homes had rooms with excessive clutter.

The report provides technical recommendations and discussions focusing on these items. Appendix A includes a summary of findings at each inspected home. Appendix B provides observations and recommendations for each home.
INTRODUCTION

The Eastern/Woodlands Office of Native American Programs requested that the Building Research Council (BRC) assess site and structural conditions contributing to mold and moisture problems in the LSICHD homes. Donald Fournier and Michelle Rook conducted the site visit from June 28th - 30th, 2004, with Rita Daniels and Dion Prescott of the LSHO as their escorts. LSICHD selected the houses.

All the homes had mold problems in the basements. The main cause of the mold was water intrusion. Causes of the water intrusion were poor site drainage, poor gutter systems, and failed sump pumps. Also, in periods of extremely heavy rains, almost any home could have water intrusion problems. In high water table areas with flat sites, extreme vigilance and care must be taken to prevent basement flooding.

All homes had exhaust fans in the bathrooms. However, in two cases, the fans were inoperable or made so much noise that the occupants chose not to use them. Each home had a kitchen exhaust fan. All but one vented to the outside, although two had poor flashing at the exterior wall penetration of the exhaust duct.

All homes were built on flat sites with low spots and holes adjacent to the foundation. Five homes had good gutter systems. Five homes had either no gutter systems or were missing occasional gutter sections, downspouts, leaders and splash blocks. All homes but one had experienced wet or flooded and damp basements. One home had a water leak through cracks in the basement floor. In addition, sump pump problems were found in two homes. Sweating pipes and/or toilet tanks were found in several homes.

SECTION 1 – METHODOLOGY

Visual inspections were used to assess mold and mildew conditions in the homes.

The results of the mold and moisture assessments were compiled on a spreadsheet, Appendix A, with broad categories of common moisture problems noted. Findings and recommendations for individually inspected houses are presented in Appendix B.

Visual Inspection

Housing inspections consisted of visual assessment of mold and moisture conditions. Assessment forms developed for the Chicago Mold and Moisture Project (a HUD Healthy Homes Program) were used to record information. The assessment forms are organized for a room-by-room inspection, thus all rooms were examined for water damage and evidence of mold. Assessment of kitchens, bathrooms, basements, utility rooms and attics included additional inspection relating to plumbing, localized ventilation, water entry and other moisture source issues. The exterior of the houses were inspected for rain water and snow melt management, including site grading, roof condition and gutter system. Since the major source of complaints and mold problems were in basements, the team focused there efforts there and attics were not inspected.
The residents were interviewed to gather history on moisture problems, plumbing leaks, winter condensation, health issues, number of occupants, and other useful information.

Digital photographs were taken at each house to visually record notable conditions.

**SECTION 2 – HOUSE DESCRIPTIONS**

The LSICHD manages 30 homes for the Tribe including Low Rent and Mutual Help units. Approximately 409 Native Americans reside on the Lower Sioux Indian Community.

Ten homes, between 7 and 25 years old, and the Social Services Building were inspected.

The 110 year old Social Services Building is on the National List of Historic Places. It is stick built on a stone foundation with a partial basement with a dirt floor.

Homes were a mix of stick built and modular homes. Most were 2 inch x 6 inch construction. Sidewall insulation was assumed to be R19 fiberglass batts. Attics were not inspected as the moisture and mildew problems were in the basements.

All homes were built over basements. Entry was either at the first floor or through a split-level foyer. There was always one floor above the basement. Most basements were half above grade and were wood below grade. Many basements had been finished wood frame with drywall. All the split foyers and several other homes had bedrooms in the basements.

All homes had propane- or natural gas-fired forced air heating systems. The furnaces reached minimum code regulations and were with or without sealed combustion. Water heaters were a mix of propane/gas and electric units.

**SECTION 3 – FINDINGS**

### 3.1 Exterior Wall/Ceiling Juncture

High indoor relative humidity during the winter combined with a cool interior surface could result in condensation based mold growth on the cool surface and at the exterior wall/ceiling juncture. This is particularly common on wood frame structures with low roof pitches. This building condition tends to restrict careful placement of ceiling insulation (reducing R-value) and is impacted by cold winds through the soffit vents.

One inspected home evidenced this condition in a bathroom on a minor scale (Figure 1).
3.2 Bathroom & Kitchen Exhaust Fans; Clothes Dryers

Properly operating and vented exhaust fans and clothes dryers remove moisture from bathrooms and homes. Exhaust fans should vent to outside. Exhaust fans were found in the main bathrooms of all homes ducted to the outside. However, some fans were inoperable or failing, leading to non-use of the fan causing mold growth in one bathroom (Figure 2). One home also had the dryer vented internally (Figure 3).

![Figure 2: Mold in the bathroom due to unused fan](image)

![Figure 3: Dryer vented internally](image)

All the kitchen fans vented to the outside, except for a recirculating one that and vented into the kitchen. Several homes had poor or missing flashing where the vents penetrated the outside walls (Figures 4 and 5).

3.3 Gutter Systems

Many homes had failed or missing gutter systems (Figure 6) and typically had only partial systems with missing or damaged downspouts and leaders (Figures 7 and 8).

![Figure 4: Missing flashing around vent.](image)

![Figure 5: Missing flashing](image)

![Figure 6: Failed or missing gutter system](image)

![Figure 7: Partial guttering with missing downspout](image)

![Figure 8: Partial guttering](image)
Some homes had only a gutter above the front door, acting as a diverter for people at the door. The lack of gutters caused extensive drip lines in the ground beneath the eaves and contributed to other site drainage problems.

3.4 Site Drainage

Site drainage is critical to maintaining a dry foundation and a dry home. The site should slope away from the home and lead rainwater away from the foundation. Also, holes and depressions were found adjacent to some foundations (Figures 9 and 10). Rainwater and snow melt collecting in these depressions contributed to wet foundations. Basement window wells were cluttered and open, or had no drainage allowing water to collect (Figures 11 and 12).

SECTION 4 – TECHNICAL RECOMMENDATIONS

The following recommendations are based on the site visit findings.

4.1 Exterior Wall/Ceiling Juncture

Whenever possible, increase the insulation levels at the eaves as much as possible.

4.2. Bathroom & Kitchen Exhaust Fans; Clothes Dryers

Large amounts of moisture are generated in bathrooms and kitchens. Properly operating and vented exhaust fans help remove moisture from these spaces.
1. Correct all kitchen vent flashing problems.

2. Replace inoperable exhaust fans immediately. Fans should be rated for a minimum 70 cubic feet per minute (CFM) at 0.25” of static pressure (the rating provided on the box is generally at 0.10” of static pressure).

3. New bathroom fans should have sone ratings no higher than 1.5. Sone is a rating for sound – the lower the sone rating, the quieter the fan. Occupants tend not to use loud fans because of the noise. Low-sone fans include Broan Solitaire and Panasonic WhisperCeiling and WhisperLite series. Low-sone fans generally cost between $75 and $100.

4. Replace existing bathroom light/fan switches with fan delay timers. A fan delay timer is a two function switch that is typically wired to a fan and a light. When the switch is turned on, both the light and exhaust fan turn on. When the switch is turned off, the light turns off but the fan continues to operate for an extended period of time. The extended period of time can be adjusted from 1 to 60 minutes. Fan delay timers cost about $35.

5. A 60 minute timer switch may be used when the bathroom fan has a separate on/off switch. Timer switches cost between $15 and $50.

6. Periodically inspect all bathroom and kitchen exhaust fan ducts. Ensure that exhaust ducts are vented outside, properly attached, and sealed to the exhaust fan housing and to roof vent caps. Repair disconnected ducts.

7. Periodically inspect dryer vents. Correct the following conditions in these ways:
   - Install new dryer vent when missing or damaged.
   - Replace crimped or cracked dryer vents.
   - Reconnect disconnected dryer vents.
   - Re-install vents to vent only to the outside of the building.
   - Replace plastic ribbed dryer vents with smooth metal vents.

4.3 Gutters

Good gutter systems provide important tools to control rainwater and move it away from the home. Replace missing gutters, downspouts, leaders, and splash blocks. If there is a concern of vandalism, consider making one connection in the downspouts weaker than others to keep repairs at a minimum.

Given the snow/ice conditions in this region of Minnesota, the following are recommendations for a gutter system:
Do not use plastic gutters, but use 0.027 to 0.032 gauge aluminum gutters suitable for the ice and snow conditions.

Half-round gutters are least affected by snow and ice (Figure 13). If unavailable or too costly, use the K-style gutters (Figure 14).

Use the heavier versions of the hidden hangers and secure every 18 inches, especially at stress points, such as corners and at downspouts.

Secure downspouts with 3 fasteners.

Use 1 downspout for every 40 feet of gutter.

Use a leaf guard system to keep gutters free of debris.

Use leaders and splash blocks at the base of downspouts to direct water at least 3 feet away from a house with a crawl space and 5-8 feet away from homes with basements.

Use flip-up leaders that may be raised to cut grass (Figures 15 & 16).

4.4 Site Drainage

Seven homes had site drainage problems. All but one basement were damp or had experienced flooding and water damage. Efforts to improve site drainage should include:

- Overall site grading to prevent water from flowing toward the homes.
- Grading directly at the foundation ensures a soil pitch away from the foundations.
- Fill the holes and dips found adjacent to foundations, even if site drainage work cannot be done or is not planned for the immediate future.
• Make sure that sump pumps are operable and discharge water away from the foundation.

• Enlarge the window wells at the split level foyer homes to allow for better water drainage. Consider adding some type of drainage to the window wells where site elevations allow it.

SECTION 5 – DISCUSSION OF COMMON PROBLEMS

5.1 Exterior Wall/Ceiling Juncture

The combination of high relative humidity and cold surfaces can lead to mold growth. If a surface approaches the dew point temperature (the temperature at which water vapor condenses based on the relative humidity), vapor will condense into liquid, be quickly absorbed by the material, and raise the moisture content of the surface. At some point, this moisture content will promote mold growth. This process often occurs at the wall/ceiling junction on exterior walls (see Figure 17).

Three reasons why the exterior wall/ceiling juncture becomes cold are:

Figure 17: Wall-ceiling corners are cold because of 1. Wind movement through soffit vents, 2. Smaller amounts of insulation at the corner and 3. Corner is outside the movement of warm air currents indoors.
1. Poorly installed insulation results in reduced amounts of insulation over the plate.

2. Cold wind may enter through soffit vents and pass through the porous insulation material, degrading its thermal performance.

3. The geometry of the corner usually means that slow-moving currents of warm air may not reach into the corners.

Dark spots occur at the wall/ceiling junction on exterior walls because these interior surfaces tend to be the coldest. These corners are the hardest places to insulate effectively, especially in homes with low-pitch roofs. With batt insulation, special pusher sticks may be used to get the insulation out to the edge. With loose fill insulation, the outside edge should be prepared correctly so that it is packed with insulation.

Many individuals and organizations (including model codes) stress the importance of attic ventilation. While it has some benefits, it also has some drawbacks. Wind washing of insulation at the edge is one of the major drawbacks. Design without attic ventilation may improve the performance of the eave area, and most design without ventilation relies on verified airtightness of the ceiling plane for good moisture performance. For more information about the benefits and drawbacks of attic ventilation see “Venting of Attics and Cathedral Ceilings” (http://brc.arch.uiuc.edu/billrose/Issues.pdf). Attic vents are, however, recommended for cold climates such as northern Wisconsin to help minimize ice dams. Attic ventilation appeared to be sufficient in these attics.

5.2 Bathroom & Kitchen Exhaust Fans; Clothes Dryers

Bathrooms, kitchens, and laundry rooms are natural moisture sources. Showers result in 100% humidity in bathrooms. Kitchens are used for cooking and cleaning. In laundry rooms, clothes dryers must remove large quantities of water from wet clothes. By removing moisture at the source in these areas, exhaust ventilation serves as a source control strategy. Exhaust ventilation dilutes the moisture and creates negative pressure, thus limiting the spread of moisture to the rest of the house until most of the moisture has been removed to the outside.

Bathroom exhaust fans, kitchen exhaust fans and clothes dryers should always vent to the outside rather than into the living space. Venting to the basement, crawl space or attic can lead to moisture problems in these areas. For this reason, localized exhaust ventilation requires ductwork.

The effectiveness of exhaust fans is based on the power of the fan, length and type of exhaust duct, and cleanliness of the fan grille. When there is excessive resistance in the ductwork, the exhaust fan motor may not be powerful enough to create sufficient airflow through the duct. The longer the duct length is, the greater the static pressure and the less air flow through the duct. Turns and bends in the ductwork also increase the static pressure and reduce flow. Smooth duct is preferred because it provides less resistance and improved flow over ribbed ductwork. For all types of exhaust ventilation, using round,
smooth sheet metal ductwork is recommended. A dirty intake grille will also greatly increase resistance and reduce airflow.

Fan capacity is typically listed between 0.10" and 0.25" of static pressure. Bathroom exhaust fans should provide a minimum ventilation rate of 70 CFM at 0.25" of static pressure. Selecting a fan capacity at 0.10" static pressure is appropriate only if the exhaust duct is smooth, straight (no more than one elbow) and less than 15 feet in length. For example, a bathroom fan with an exhaust ventilation rate of 90 CFM or 100 CFM (at 0.10 inch) may be required to obtain 70 CFM at 0.25 inch of static pressure if there are numerous elbows, the exhaust duct is ribbed and the length is over 15 feet. Fan performance curves should be reviewed to determine ventilation rates at 0.25 inch.

Replace inoperable kitchen exhaust fans whenever possible and vent to the outside. The fans should have a minimum exhaust capacity of 150 CFM. Under no circumstances should recirculating fans be installed in place of the kitchen exhaust fans. These must vent outside.

Dryer vents should be smooth-surfaced rigid duct. Non-combustible flexible metal duct approved for dryer venting may also be used. Duct joints should be in the direction of air flow. Ducts should not be fastened with screws or fasteners that extend into the duct. Length of the duct run should be minimized, especially with flexible metal duct. Flexible metal duct should be installed without dips or sags. Insulate dryer vents extending through non-conditioned spaces.

Minimum duct diameter should be 4 inches and length should not exceed 25 feet from the dryer outlet to the termination point. If duct length is greater than 25 feet, use 5-inch diameter duct.

Dryer vent caps should have a backdraft damper that closes when the dryer is not being used. Insect screens or small wire cages should not be installed over the vent cap.

5.3 Gutters

Collect rainwater and snow melt from the roof and distribute it away from the foundation with a gutter system. Make flashings around chimneys and vents watertight by:

- Include waterproofing underlayment at the eaves as part of re-roofing to prevent water damage caused by ice dams.

- Pitch the gutters to the downspout. Short gutters may be hung level. In hip roof homes, consider using downspouts only on the downhill side not on the uphill side. In areas with a moderate amount of trees, consider large gutters and downspouts where leaves and debris can be flushed more easily. Ensure the gutters hangers are solid to keep the gutter from sagging.
• Secure downspouts to the house and never undersize them, although some oversizing is acceptable. Fasten elbows and straight sections together with pop rivets—screws that project into the downspout can lead to clogging.

• At the base of the downspout, direct water away from the foundation and past the backfill onto the undisturbed soil which may be 3 feet to 8 feet from the edge of the house. If water dumps close to the foundation, into the backfill, it will concentrate next to the foundation. Discharge the water away from the house using downspout extenders (sections of straight downspout) or splash blocks. Both are often disturbed when lawns get mowed. A notched section of downspout hinged to the elbow at the base of the downspout can solve this problem. Slope the soil at the base of the downspout away from the house at a minimum of 5% slope with a 6 inch fall in the first 10’ away from the house.

• Keeping gutters clean in wooded areas can be a maintenance issue. A gutter guard system can help keep debris out of the gutter, thus minimizing maintenance, while allowing water to drain into the gutter.

Two such gutter guard systems are the *PermaFlow Gutter Guard System* and the *WaterFall Gutter Guard System* (Figure 18). These systems cost about $4.50 per 3’ section and are designed for a 5” K style gutter (8’ sections are sold to contractors).

### 5.5 Site Drainage

Good site drainage includes dealing with water that falls on the roof and on the ground. Design and build the roof so water moves to the edge, falls on a soil surface, and percolates downward through the soil—more in sandy soils and less in clayey soils—to prevent mold and moisture problems. The water that does not percolate downward will move along the soil surface following the slope out to the downhill edge of the site. If water accumulates in the soil in contact with the foundation water problems occur. The soil in contact with the foundation should be the driest soil on the site following a rainstorm. Homes with dry foundations (basements, crawl spaces and slabs) are usually dry homes. Keeping the foundation dry is the key to a good indoor environment in most homes. To keep the foundation dry, keep the soil dry that is next to the foundation.

![Figure 18: PermaFlow Guard System (left) and the WaterFall Gutter Guard System (right)](image)
Keeping the soil that touches the foundation dry involves a few general rules, and some specific guidelines:

1. The first general rule is the rule of concentration - damage is worse where greater quantities of water are concentrated. A valley on a roof acts like a funnel, with the greatest concentration of water at the base of the valley. Gutters act like funnels that collect water from the edge of the roof and concentrate it in the downspout. On the land, valleys and swales act like collectors or funnels that concentrate the water on the site. If the water management design makes use of funnels (such as valleys, gutters or swales) then they require maintenance to make sure they work as intended. Damage is worst where a valley, gutter, or swale is blocked.

2. The second general rule is the ground-roof rule—treat the soil surface as if it were a low-slope roof. Pitch the surface away from the house—the steeper the pitch, the better the drainage. Imagine all the water moving to the low edge of the site, and imagine how best to get it there. Avoid areas near the building that can act as water collectors.

Specific site drainage guidelines include:

- Build the house on a crown, not a hole. With sufficient exposed foundation, the site grading at the house can be improved. If the house hugs the ground, improvements at the foundation are more difficult. A minimum of 8 inches of exposed foundation should show between the ground and the beginning of the siding.

- Identify localized dips and holes immediately adjacent to the foundation and fill with dirt. Tamp the fill material to prevent future settling. Provide sufficient fill material to ensure that water drains away from the foundation.

- If the house has no gutters or ineffective gutters, then the base of the soil around the house serves as a gutter. The surface should prevent water from splashing onto the siding of the house and should be designed with pitch to effectively move water away from the house.

- Good tamping or compaction of the backfill is very helpful because it helps keep water up on the surface where it can be managed by slope. Soil at the outside corners of the foundation, where the downspouts are usually found, can always be tamped because the corner will never collapse inward.

- Bushes and other plantings may be very helpful, especially if their root balls soak up a lot of water. Also they can be planted strategically near downspouts so that the downspout extenders are less likely to be kicked off or removed during lawn mowing.
## Appendix A: SITE: Lower Sioux Reservation

### SUMMARY SITE VISIT REPORT

#### DATE: June 27-30, 2004

<table>
<thead>
<tr>
<th>Inspection Number</th>
<th>Name</th>
<th>Site</th>
<th>Address</th>
<th>Building Age</th>
<th>Occupancy</th>
<th>Foundation Type</th>
<th>Model and Framing Type</th>
<th>Heat Type</th>
<th>Site Drainage Problems</th>
<th>Gutters System Problems</th>
<th>Leaks from Exterior</th>
<th>Wet Basement or Crawlspace</th>
<th>K-Plumbing Problems</th>
<th>BR-Plumbing Problems</th>
<th>BR-Exhaust Ventilation Problems</th>
<th>K-Exhaust Ventilation Problems</th>
<th>Exterior wall EXTRACTION problems</th>
<th>Attic Problems</th>
<th>Visible Mold (Column #)</th>
</tr>
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<tbody>
<tr>
<td>1-1</td>
<td>Original School House</td>
<td>39474 Res. HWY 1</td>
<td>NA</td>
<td>1889</td>
<td>Vacant</td>
<td>Rubble Stone</td>
<td>Waddle and Dab</td>
<td>Propane Forced Air</td>
<td>Yes</td>
<td>Yes</td>
<td>Chimeny</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>DNV</td>
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<td>1-2</td>
<td>Rita</td>
<td>32983 Res. HWY 4</td>
<td>MH</td>
<td>1980-84</td>
<td>1A: 0C</td>
<td>Wood Basement</td>
<td>Ranch: 2X6 Modular</td>
<td>Propane Forced Air</td>
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<td>Yes</td>
<td>Range Hood Vent, BR Exhaust Fan</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
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<td>No</td>
<td>Brick Shelf</td>
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<td>DNV</td>
<td>DNV</td>
<td>DNV</td>
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<td>Basement Window</td>
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<td>No</td>
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<td>36097 Co. HWY 2</td>
<td>?</td>
<td>+/-1950</td>
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<td>Concrete Block Basement</td>
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<td>Yes</td>
<td>Basement Window/Wall</td>
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<td>No</td>
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<td>Basement Floor</td>
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<td>Paul</td>
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</tbody>
</table>

MH = Mutual Help
TK = Turnkey/Rent to Own
LR = Low Rent
N/A** = Owner Not Present
DNV=Did Not View
Appendix B-Lower Sioux Indian Community Housing Department
Technical Housing Assessment Report

June 27-30, 2004

**Inspection Number:** 1-1  
**Address:** 39474 Res. HWY 1  
**Model Type:** Original School House  
**Foundation:** Stone basement and crawl space  
**Construction:** 2 x 4 Wood Frame  
**Heat Type:** Propane Forced Air  
**Bedrooms:** None  
**Occupancy:** Business offices  
**Age:** 115 Years

---

**Mold and Moisture Conditions:** Mold was present in the basement.

**Site Drainage and Rainwater Management:** No guttering system was present and drip lines were evident. The site was flat in places and sloped away from the foundation in others.

**Foundation Conditions:** The building rested on a stone foundation. Although there was evidence of multiple repairs, the foundation was pulling away and failing in places.

**Basement Condition:** The basement was wet. The sewer line sloped toward the basement, rather than away from the building (Figure 2). An employee for the business using the building reported that the sewer line froze every winter. The cleaning out of this line and its improper sloping was probably the source of moisture in the basement leading to mold on the floor. The perimeter was not insulated; supply pipes were uninsulated. No vapor barrier was present on the dirt floor.

**Crawl Space Conditions:** The crawl space was dry, cluttered, and uninsulated. No vapor barrier was present.

**Exterior Conditions:** Flashing problems around the chimney and leaks inside the building were evident. The roof was in questionable condition and some shakes were missing and others curled (see Figure 3). The siding was in poor condition in places. The caulking was dried and needed repaired.

**Bathroom:** The toilet was securely fastened to the floor. There was no shower or bath fan present.
Kitchen: The propane stove had no range hood.

Interior Conditions: The interior was in good condition except for the leaks around the chimney.

Attic: The attic was not viewed.

Occupant Notes: No one lived in the home, but businesses used it during the day and meetings were held there in the evening sometimes.

Discussion/Recommendations:

1. Insulate all plumbing lines.
2. Insulate basement and crawl space.
3. Install vapor barrier in basement and crawl space.
4. Reinstall the sewer line at a correct slope and ensure clean-out caps are in place.
5. Repair roof flashing at the chimney.
6. Replace the exterior caulking.
7. Install a range hood exhaust fan.

Basement Conditions: There were faults and walls were insulated. The dryer vented to the basement. Water was dripping from the air conditioner. Visible mold was present and was most likely due to water that had come in from recent heavy rains. Also, the occupants changed the furnace filter every four months.

Exterior Conditions: There were flashing problems around the range hood vent (Figure 2). The venting was new. The vapor barrier for the wood foundation did not go all the way up under the siding and was exposed to the weather (Figure 3).

Bathroom: The toilet was securely fastened to the floor. The exhaust fan was operated by a (single/separate) switch and was in good condition. But during heavy rain, water entered and dripped from the fan.
Appendix B-Lower Sioux Indian Community Housing Department
Technical Housing Assessment Report

Inspection Number: 1-2
Address: 32983 Res. HWY 4
Model Type: Ranch
Foundation: Wood basement
Construction: 2 x 6 Modular
Heat Type: Propane Forced air
Bedrooms: 2
Occupancy: 1 Adult
Age: 20 Years

Mold and Moisture Conditions: A few spots of mold were along the bottom of the basement walls and near the water softener. The occupant reported a former plumbing leak in the corner with visible mold. She used bleach to remove the basement mold, but she had little information regarding the mold because it was primarily out of sight.

Site Drainage and Rainwater Management: The house had been re-sided and had new gutters; drip lines were evident from the lack of an earlier system, yet some gutter sections had not yet been installed (see Figure 2). The site generally sloped away from the house.

Foundation Conditions: The house rested on a wood foundation in good condition.

Basement Condition: Floor joists and walls were insulated. The dryer vented to the basement. Water was dripping from the air conditioner. Visible mold was present and was most likely due to water that had come in from recent heavy rains. Also, the occupant changed the furnace filter every four months.

Exterior Conditions: There were flashing problems around the range hood vent (Figure 2). The siding was new. The vapor barrier for the wood foundation did not go all the way up under the siding and was exposed to the weather (Figure 3).

Bathroom: The toilet was securely fastened to the floor. The exhaust fan was operated by a (single/separate) switch and was in good condition, but during heavy rain water entered and dripped from the fan.
**Kitchen:** The electric stove had a range hood exhausting through the wall.

**Interior Conditions:** The interior was in good condition. There was a central return through the door to the furnace closet, but no return ducting. The furnace flue iced in winter.

**Attic:** No attic was present, because the ceilings were vaulted.

**Occupant Notes:** The one adult living in the home suffered from a persistent cough.

**Discussion/Recommendations:**

1. Insulate plumbing supply lines.
2. Replace flashing at range hood vent.
3. Install missing gutter sections.
4. Redirect dryer vent to the exterior of the house.
5. Replace or repair the kitchen drain piping.
Appendix B-Lower Sioux Indian Community Housing Department  
Technical Housing Assessment Report  

Inspection Number: 1-3  
Address: 5th Street, Morton  
Model Type: Ranch  
Foundation: Wood and concrete basement  
Construction: 2 x 6 Modular  
Heat Type: Propane Forced air  
Bedrooms: 3  
Occupancy: 2 Adults and 1 child  
Age: 13 Years  

Mold and Moisture Conditions: Mold was behind the baseboard molding in the basement near the door (Figure 2). Prior water had leaked on the dropped ceiling panels, but they were now dry. The occupant reported a former hot water tank leak in the laundry room. She cleaned the mold and the cut sheetrock away; the mold has not returned.

Site Drainage and Rainwater Management: The site was flat and drained toward the foundation.

Foundation Conditions: The house rested on a wood and concrete foundation which was in good condition.

Basement Condition: The basement was dry. Visible mold was present behind the baseboard and in drop ceiling tiles near the walk-out door; it was also present in the laundry room.

Exterior Conditions: The flashing was absent at the deck/house junction and at the brick shelf (Figure 3). Caulk joints were compromised.

Bathroom: The bathroom was not inspected.

Kitchen: The kitchen was not inspected.

Interior Conditions: The interior conditions were good.

Attic: As there were no problems or complaints, the attic was not inspected.

Occupant Notes: Two adults and one child lived in this home.
Discussion/Recommendations:

1. Install flashing at the deck and the brick shelf.

2. Replace the caulk joints around the exterior door moldings.

3. Remove the baseboard and clean up the mold.
Appendix B-Lower Sioux Indian Community Housing Department
Technical Housing Assessment Report

Inspection Number: 2-1
Address: 32759 County HWY 2
Model Type: Ranch
Foundation: Wood Basement
Construction: 2 x 6 Modular
Heat Type: Propane Forced Air
Bedrooms: 4
Occupancy: 2 Adults and 4 Children
Age: 10 Years

Mold and Moisture Conditions: Mold was present in the basement.

Site Drainage and Rainwater Management: The site was flat. There was a missing leader in the guttering system.

Foundation Conditions: The house rested on a wood foundation.

Basement Condition: The basement was dry. Visible mold was present in the back bedroom which happened to be in the same corner with the missing downspout leader (Figure 2). Mold was also present on a basement window and in the cellar stair carpeting. The sump pump was running continuously. The occupant reported a recent leak in the basement window, where the window well filled and spilled down the interior wall (see Figure 3). She also reported condensation on the sump pump outlet pipe. She cleaned the mold with bleach, but the mold returned.

Exterior Conditions: The roof had some shingles broken from wind damage. The foundation was overgrown with weeds and brush. Window wells had materials and clutter in them.

Bathroom: The bathroom was not viewed.

Kitchen: The propane stove had a range hood exhaust fan venting to the house exterior. The range hood was new with the vent penetration improperly installed and flashing missing (Figure 4).
**Interior Conditions:** The interior conditions were good. The occupant reported winter condensation on the windows upstairs.

**Attic:** No attic was present, since the ceilings were vaulted.

**Occupant Notes:** Two adults and four children lived in the home.

**Discussion/Recommendations:**

1. Replace and secure the downspout leader.
2. Clean out all the window wells. Dig out the one window well by the basement stairs and add crushed rock for better drainage.
3. Clear weeds and brush from around the foundation.
4. During winter months, regularly wipe condensation from windows and sills.
5. Repair siding at range hood vent and properly flash.
6. Clean and disinfect mold with a mixture of water and bleach or a disinfectant, such as Pinesol, in the basement bedroom and closet. Remove and discard carpeting, if moldy.
7. Repair sump pump that runs continuously until the water level drops to below the intake and the pump runs dry. Clean and insulate the sump pump discharge line so condensation will not build up and cause mold.

**Exterior Conditions:** The driveway and sidewalk slope toward a shallow part of the site. The front of the house had recently been landscaped around the window well, but this proved ineffective in preventing rainwater from entering the basement through the window.

**Bathroom:** The bathroom was not viewed.

**Kitchen:** The propane stove had a range hood exhaust fan venting to the exterior of the house.

**Interior Conditions:** The condition was good, except as noted in the basement.

**Attic:** The attic was not inspected since there were no mold problems on the upper floor.

**Occupant Notes:** Three adults and one child lived in the house.
Appendix B-Lower Sioux Indian Community Housing Department
Technical Housing Assessment Report

Inspection Number: 2-2
Address: 40164 Res. HWY 3
Model Type: Split Level
Foundation: Wood Basement
Construction: 2 x 6 Stick Built
Heat Type: Propane Forced Air
Bedrooms: 3
Occupancy: 3 Adults and 1 Child
Age: 24 Years

Mold and Moisture Conditions: Mold was in the basement. The occupant reported a basement window leaked; that when the sump pump failed in 2002, two feet of water collected in the basement; and that she cleaned the mold with bleach, but the water and mold returned after the next rain.

Site Drainage and Rainwater Management: The site was flat and drained toward the foundation, especially in front of the house (Figure 2).

Foundation Conditions: The house rested on a wood foundation.

Basement Condition: The basement was damp with visible mold and water damage. Mold was also present on a basement window (Figure 3).

Exterior Conditions: The driveway and sidewalk slope toward a shallow part of the site. The front of the house had recently been landscaped around the window well, but this proved ineffective in preventing rainwater from entering the basement through the window.

Bathroom: The bathroom was not viewed.

Kitchen: The propane stove had a range hood exhaust fan venting to the exterior of the house.

Interior Conditions: The condition was good, except as noted in the basement.

Attic: The attic was not inspected since there were no mold problems on the upper floor.

Occupant Notes: Three adults and one child lived in the house.
Discussion/Recommendations:

This house was set too low in the ground leading to water infiltration problems. The lot was too flat and sloped toward the house in certain places. This led to major problems during rain storms. The owner had a proposal from a basement water control company to install an underground tile system below the basement slab.

The following actions are recommended:

1. Install longer extensions on all the downspouts; 8 to 10 feet is recommended.

2. Grade the portions of the yard that slope toward the house, especially in the front to insure water flows out to the yard and away from the house, especially at the window well.

3. Dig out the window well, make it larger and deeper, and fill it with crushed stone to 6-12 inches below the window.

4. Install a new window in the basement that is of higher quality and resists leaking. Insure that it is properly caulked and the exterior walls are water proof. Consider a shorter window so it is further above the ground. Be sure to seal the foundation wall, if the window is replaced.

5. Remove any water damaged materials and replace.

6. Clean and disinfect any areas where mold is present with a mixture of bleach and water or a disinfectant, such as Pinesol.

7. The installation of the underground tile system will not improve the grading problems and window leak. It is not recommended. The best course of action is to remove the cause of water infiltration into the home.

8. It would also be a good idea to have a small backup generator that could be used to power the sump pump in case of electrical loss during a rain storm. Perform annual maintenance on the sump pump.
Inspection Number: 2-3
Address: 38631 Res. HWY 1
Model Type: Split Level
Foundation: Wood Basement
Construction: 2 x 6 Stick Built
Heat Type: Propane Forced Air
Bedrooms: 3
Occupancy: 1 Adult
Age: 24 Years

Mold and Moisture Conditions: Mold was present in the basement. The occupant reported that the basement window leaked during a major storm. She cleaned the mold with soap and water. She runs a dehumidifier in the basement.

Site Drainage and Rainwater Management: The site was well drained except for along the walkway in front of the basement window (Figures 2 and 3).

Foundation Conditions: The house rested on a wood foundation which appeared to be in good condition and had no problems.

Basement Condition: The basement was dry, but visible mold indicated a former leak.

Exterior Conditions: The home was well maintained and gutters and downspouts were in place along with leaders.

Bathroom: The bathroom exhaust fan was inoperable, yet there was no mold present.

Kitchen: The propane stove had a range hood exhaust fan venting to the exterior of the house.

Interior Conditions: The inside conditions were good.

Attic: The attic was not inspected as there were no reports or evidence of any problem associated with roof leaks or thermal bridging.

Occupant Notes: One adult female lived in this house.
Discussion/Recommendations:

1. During a major rain storm, water came into the basement through the window. These split level houses are set too far into the ground and the basement windows tend to be an entry point for rainwater.

2. Re-grade the walkway and yard where it slopes toward the front of the house to ensure water flows out to the yard and away from the house, especially at the window wells. Dig out the window well, make it larger and deeper, and fill it with crushed stone to 6-12 inches below the window. Consider adding a drain pipe that passes under the walk and allows the window well to drain into the front yard and down the slope.

3. Install a new window in the basement that is of higher quality and resists leaking. Ensure that it is properly caulked and the exterior walls are waterproof. Consider a shorter window so it is further above ground. Be sure to seal the foundation wall if the window is replaced.

4. Remove any water damaged materials and replace.

5. Clean and disinfect any areas where mold is present.

6. Clean up any mold and pull up carpeting. If the carpeting and pad can be dried, then it may be possible to reuse them. Both the pad and carpeting should be replaced if there is mold on them. Clean up the wall with detergent and disinfectant, such as Pine sol or a mixture of water and chlorox.

7. Repair or replace the bathroom exhaust fan.
Appendix B-Lower Sioux Indian Community Housing Department
Technical Housing Assessment Report

Inspection Number: 2-4
Address: 32609 County HWY 2
Model Type: Two Story with Several Additions
Foundation: Concrete Block Basement
Construction: 2 x 4 Stick Built
Heat Type: Propane Forced Air
Bedrooms: 4
Occupancy: 2 Adults
Age: +/-50 Years

Mold and Moisture Conditions: There was no visible mold. The occupant reported that the basement flooded during a recent major storm for the third time in ten years due to heavy rains and a fallen downspout. The roof had leaked before it was recently replaced.

Site Drainage and Rainwater Management: The site had poor drainage toward the foundation and depressions near the foundation. One depression was drilled by a downspout with a lost leader directly outside of where the basement repeatedly flooded (Figure 2). Beyond that area the drainage of the site was good.

Foundation Conditions: The house rested on a concrete block foundation in good condition. Parts of the house were on a crawl space.

Basement Condition: The basement had flooded during previous storms. The basement was currently damp and drying out from recent flooding.

Exterior Conditions: Exterior conditions were good.

Bathroom: The bathroom exhaust fans were operated by a (single/separate) switch and were in good condition. One vented to the exterior of the house; one did not.

Kitchen: The propane stove had a recirculating range hood fan.

Interior Conditions: The dryer vents into the laundry room (see Figure 3).

Attic: The attic was sealed with no apparent problems.
Occupant Notes: Two adults lived in the home. Both occupants have developed allergies; one has sinus drainage and a cough.

Discussion/Recommendations:

1. Replace the recirculating range hood fan with a fan exhausted to the exterior of the house.

2. Exhaust the bathroom fan to the exterior of the house.

3. Install a dryer exhaust to vent to the exterior of the house.

4. Fill the depression from the lost leader and secure the downspout in place. Add a 7-8 foot extension to the downspout at the location.

5. Consider adding a dehumidifier to the basement.
Appendix B-Lower Sioux Indian Community Housing Department  
Technical Housing Assessment Report  

**Inspection Number:** 2-5  
**Address:** 40061 Res. HWY 3  
**Model Type:** Split Level  
**Foundation:** Wood Basement and Crawl Space  
**Construction:** 2 x 6 Stick Built  
**Heat Type:** Propane Forced Air  
**Bedrooms:** 2½  
**Occupancy:** 2 Adults and 5 Children  
**Age:** 24 Years  

**Mold and Moisture Conditions:** There was no present mold or flooding evident in the home. The occupants had cleaned the mold with bleach.

**Site Drainage and Rainwater Management:** The site was either flat or sloped away from the house. The gutter system was in poor condition, with some gutter sections, downspouts, leaders and splash blocks missing (Figure 2).

**Foundation Conditions:** The house rested on a wood foundation with part full basement and part inaccessible crawlspace.

**Basement Condition:** The basement was dry, with insulation on the walls and a floor drain.

**Exterior Conditions:** The gutter system had failed, weeds grew along the foundation, the metal roof was in good condition, and some windows needed replacement (Figure 3).

**Bathroom:** The bathroom exhaust fan was inoperative, the tub caulk joint had long been compromised, and the sheet flooring had curled. Evidence of mold and water on the sub floor was viewed from the basement, indicating that the floor sheathing was saturated and failing both around the toilet drain penetration and below the bathtub’s outer edge (Figure 4).

**Kitchen:** The propane stove had a range hood fan exhausted to the exterior. Mold grew on the windows, especially during winter.
Interior Conditions: The house had experienced past plumbing leaks in the kitchen and bathroom. The leaks were repaired, but the water damage was not.

Attic: The attic was not inspected, since there were no complaints or visible problems from that origin.

Occupant Notes: Two adults and five children had lived in the home for two years. The occupants had indicated that they were considering remodeling and building an addition to accommodate the large family.

Discussion/Recommendations:

1. Replace the gutter system, including long leaders and splash blocks.

2. Repair or replace the bathroom exhaust fan.

3. Repair damage due to tub caulk joint failure and replace the caulk joint. Lay a new bathroom floor.

4. Replace damaged windows.

5. Since the occupants had stated the possibility of renovating the house and building an addition, we recommend they evaluate whether to demolish the home and replace it with a modular home large enough to accommodate the family without anyone living in a basement.
Appendix B-Lower Sioux Indian Community Housing Department
Technical Housing Assessment Report  
June 27-30, 2004

**Inspection Number:** 2-6  
**Address:** 32767 County HWY 2  
**Model Type:** Ranch  
**Foundation:** Concrete Block Basement  
**Construction:** 2 x 4 Stick Built  
**Heat Type:** Propane Forced Air  
**Bedrooms:** 3  
**Occupancy:** 2 Adults and 3 Children  
**Age:** 7 Years

**Mold and Moisture Conditions:** Mold was present on the lower basement walls and in the bathroom.

**Site Drainage and Rainwater Management:** The site drainage was good. The gutter system was new, but was only installed on the front of the garage and over doorways.

**Foundation Conditions:** The house rested on a concrete block foundation, but cracks were spreading in the basement floor slab (Figure 2) where water came up during wet weather.

**Basement Condition:** The basement was dry with insulation on the walls and a floor drain. The sump pump was inoperable and contained standing water. Mold was present on walls, along the baseboards, and in the bathroom (Figure 3). A neighborhood sewer had backed up through the floor drain before the basement was finished.

**Exterior Conditions:** Weeds and grass grew too close to the foundation. Some extraneous materials were in the widow wells. The house needs to be repainted or stained to protect the siding.

**Bathroom:** The basement bathroom had mold since the exhaust fan had broken three years before. Mold was on the walls. Also, the minor damage in the upstairs bathroom was due to multiple toilet overflows.

**Kitchen:** The propane stove had a range hood fan exhausted to the exterior of the house.

**Interior Conditions:** The interior was in good condition.

**Attic:** The ceilings were vaulted, so no attic was present.
**Occupant Notes:** Two adults and three children lived in the house. Sleeping in the basement triggered symptoms of the adult’s childhood asthma.

**Discussion/Recommendations:**

1. Install a complete gutter system on the home with 8 foot lead extensions.

2. Repair or replace the basement bathroom exhaust fan.

3. Repair or replace the sump pump.

4. Remove the weeds along the foundation and clutter from the window wells.

5. Clean and disinfect with a mixture of water and chlorox, or a disinfectant, such as Pinesol, all the moldy places.

The two sources of the mold include:

1. The inoperable bathroom ventilation fan in the basement bathroom which needs repaired or replaced.

2. The mold throughout the basement walls from the water penetration into the basement during rainy periods.

The cure includes:

1. Repair the sump pump. Fixing the sump pump will take away the pressure of the water table coming through the floor.

2. Add full gutters, downspouts, and long leaders to the house to keep that pressure from building up during rainstorms.

3. Repair or replace the basement bathroom exhaust fan.

4. Install a dehumidifier in the basement.
Appendix B-Lower Sioux Indian Community Housing Department Technical Housing Assessment Report

Inspection Number: 3-1
Address: 38749 Res. HWY 1
Model Type: Split Level
Foundation: Wood Basement
Construction: 2 x 6 Stick Built
Heat Type: Propane Forced Air
Bedrooms: 3
Occupancy: 2 Adults and 2 Children
Age: 24 Years

Mold and Moisture Conditions: Mold was present in the basement.

Site Drainage and Rainwater Management: The site was partially flat, partially draining from the foundation, and partially draining toward the foundation with depressions near the foundation. The gutter system was in poor condition. Gutter sections, downspouts, leaders, and splash blocks were missing (Figure 2).

Foundation Conditions: The house rested on a wood foundation.

Basement Condition: The basement was damp and had visible mold in many areas. Water came in during rain storms and previous plumbing problems had caused basement flooding (see Figure 3).

Exterior Conditions: Windows and siding were in poor condition and the basement windows were set too close to the ground level (see Figure 4). There were weeds and clutter around the foundation and under the porches.

Bathroom: The basement bathroom was in poor condition and unusable. The upstairs bathroom caulking was in poor condition.

Kitchen: The propane stove had a recirculating range hood fan, which replaced a ducted exhaust fan. The cabinetry was in poor condition.
Interior Conditions: Conditions inside the house were poor. Significant clutter and extensive mold were present in all basement rooms.

Attic: The attic was not inspected since there were no reported problems originating in the attic.

Occupant Notes: Two adults and two children lived in the home. One child was sleeping in the basement and had occasional coughs.

Discussion/Recommendations:

1. This home had the same moisture problems as all the other inspected split level foyer homes. This home was in very poor condition with extensive mold, failing windows, and extensive interior damage to cabinetry, doors, vanities, etc. Bringing this home to acceptable standards requires extensive mold clean up and an entire interior and exterior renovation. We recommend that this home be demolished and replaced.

In this is not possible, the following is recommended:

2. Clean and disinfect areas with extensive mold.

3. Replace un-vented kitchen fan with a fan exhausting to the outside.

4. Replace the gutter system and install long leaders (6-8 feet).

5. Replace the living room window.

6. Repair the water damage to the basement areas.

7. Dig out the window wells and make them larger and deeper. Fill with crushed stone to 6-12 inches below the window. Consider adding a drain line to direct water away from the house. Re-grade the front of the house to insure water flows away from the foundation.

8. Install new windows in the basement that are of higher quality and resist leaking. Ensure that it is properly caulked and the exterior walls are waterproof. Consider a shorter window so it is further above the ground. Be sure to seal the foundation wall if the window is replaced.

9. Remove and replace any water damaged materials.

10. Clear weeds and clutter from around the foundation.
Discussion/Recommendations:

1. The split level home had the same problem as all the others, it was set too far into the ground and was susceptible to water coming in the downstairs bedroom window during heavy rains. The occupant had done an excellent job insuring that the gutters kept the water away from the foundation. The home was in excellent condition.

2. Replace the bathroom caulking.

3. Replace the sewer cut-out cap. It may also be possible to roll up some insulation and place it in the cut-out as long as it remains tightly in place and does not slide down to clog the line. This may prevent freezing in the winter.

4. Replace the many siding corner pieces that are missing.

5. Clean up the mold in the bath at the top plate. This is probably due to forgetting to turn on the exhaust fan in the winter. It should not return once cleaned up as long as the fan is used. The fan should be left to run about 15 minutes after someone has taken a shower.

6. Consider replacing the basement window with one of higher quality that may resist inflow of rainwater better. If replaced, use a shorter window to get more ground clearance. Replace the front stoop that has settled and in tilted towards the house. Dig out the window well about 18 inches, install a prefab window well, and fill the bottom with about 6 inches of crushed stone to provide a small collection reservoir and infiltration point.