

MINNESOTA GREENSTAR PROGRAM AND NATIONAL GREEN BUILDING STANDARD COMPARISON REPORT

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Minnesota GreenStar Program and National Green Building Standard Comparison Report

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Executive Summary

The purpose and scope of this report is to provide a comparison the National Association of Home Builders (NAHB) National Green Building Standard (NGBS) and the Minnesota GreenStar New Homes and Remodeling standard, both of which are available in Minnesota. This report compares and contrasts the programs' basic processes, general usability, and the environmental benchmarks that each program's standard embodies. This report is based on the Minnesota GreenStar checklist and manual versions available as of January 1, 2009, and the National Green Building Standard Second Public Draft version.

The MN GreenStar Program first formed in 2005 through an ad-hoc committee called the Green Remodeling Group, with the purpose of being a green building standard focused specifically on remodeling. The remodeling standard, one of the first in the country, was compiled with help from many different Minnesota-based companies and organizations.¹ A new home construction program was added with partnerships from the Builders Association of the Twin Cities (BATC) and the non-profit organization The Green Institute. The two programs officially became known as Minnesota GreenStar Certified Green Homes and Remodeling, and the organization achieved non-profit 501(c)3 status in 2008.

The MN GreenStar program was initially designed to be a green building standard that was "desirable, accessible and available to all." Its intended participants are builders and remodelers, as well as architects and interior designers. Contractors, suppliers, and homeowners are also targeted through education and training programs.

The National Association of Home Builders (NAHB) is a member-driven trade organization whose mission is "to enhance the climate for housing and the building industry." The NAHB was officially formed in 1942 as a combination of the National Home Builders Association and the Home Builders Institute of America. The formation was initially created to serve as a voice for builders in response to wartime restrictions in the home building sector. Today the NAHB continues to represent the home building industry's interests on Capitol Hill and in the housing finance sector while offering education, economic and consumer trend reports and other services to its members. Membership is now over 200,000 individual companies, including over 800 state and local associations. One third of NAHB's membership includes builders and remodelers, and the remaining two-thirds are industry-related. NAHB also offers international membership. NAHB claims that over 80 percent of homes built in the US are by NAHB members.

The National Green Building Standard and MN GreenStar both have potential for successful projects in Minnesota. Both programs address important environmental standards and offer educational seminars, websites and tools to help builders understand the process

¹ Participants in the GreenStar Program formation included builders, remodelers, interior designers, architects, lumber yards, flooring distributors, building science professionals, MN Department of Commerce - Energy Office personnel, the University of Minnesota's Center for Sustainable Building Research (CSBR), utilities, and the MPCA Green Building specialists, as well as members of BATC and National Association of the Remodeling Industry (NARI-MN).

of certification and the importance of green building. To support education services, the NAHB has a fully developed website specifically dedicated to green building practices. Both programs function effectively in terms of providing information for builders on documentation and registration requirements for project certification. NAHB focuses education services on a builder audience, while MN GreenStar includes builders as well as homeowners and other project partners in their education programs.

One of the strengths of the NAHB program is an online scoring tool that functions well when scoring the project in a linear fashion, and the associated table of contents allows the user to move through the standard as needed. The NGBS has improved credits relating to environmental impacts since the Model Green Homebuilding Guidelines (MGHG) were first developed. It should also be mentioned that the NAHB has achieved ANSI accreditation for their National Green Building Standard (NGBS), the first green building program in the United States to achieve this credential.

The leading strength of the MN GreenStar program is that it is a regional standard that is specific to building codes and conditions in Minnesota. The MN GreenStar program is also unique in providing a remodeling standard that is highly focused on the needs and conditions of remodeling projects. In contrast, the remodeling program within the NAHB program requires users to use the new home standard to evaluate renovation projects. The MN GreenStar checklist follows the natural order of a building project, has a strong sense of how remodeling projects work, and provides credits that are specific to regional issues in Minnesota. The MN GreenStar program provides free downloadable manuals and offers fully functioning searching capabilities in its checklists.

Both programs demonstrate opportunities for improvement. A few of the places where the NGBS program could be enhanced include addressing the fee associated with the required purchase of a manual, improving access to what is now members-only information, revising the credit structure and scoring tool to more closely follow a typical building process, changing the remodeling standard so that it is less strongly based on new construction practices, and improving the searching capabilities within the online scoring tool. The online scoring tool also may not be the best choice for builders in rural communities or those working without a high-speed Internet connection. For MN GreenStar, the quality of information in the manuals is inconsistent in terms of the level of detail and guidance that is provided for some sections, and the checklist navigation can seem confusing to a new user or someone unfamiliar with the program. MN GreenStar currently does not offer an online scoring method.

With all green building standards, going through the process with a first project will answer many questions and familiarize the user with the program and its operational details. The NGBS and NAHB are still working out the full functionality of the scoring tool and plan to announce new features in the second quarter of 2009. MN GreenStar released Version 2.0 in April 2009, which is intended to address many of the areas for improvement, and future enhancements to the program are planned to include online scoring capabilities. In the meantime, Minnesota has strong programs to choose from that can help increase participation in green building, whether it is new home construction or remodeling.

Table 1, Summary of Program Elements

Program Element	MN GreenStar	NAHB NGBS
Full Name of Program	Minnesota GreenStar New Homes and Remodeling Standard	National Association of Home Builders (NAHB) National Green Building Program (NGBS)
Program Version Reviewed	MN GreenStar checklist and manual versions available as of Jan. 1, 2009	Second Public Draft version as of Dec. 21, 2007
Program Year of Origin	MN GreenStar Program first formed in 2005 through an ad-hoc committee called the Green Remodeling Group and the organization achieved non-profit 501(c)3 status in 2008.	The NAHB released Model Green Homebuilding Guidelines (MGHG) in 2005. In Feb. 2007 NAHB announced the National Green Building Standard (NGBS). In Jan. 2009, the NGBS received approval by the American National Standards Institute (ANSI).
Governance	The MN GreenStar standard is governed by a 14-member Board of Directors.	The NAHB has a staff of over 300, and over 2,800 members that serve on the board of directors.
Certified Projects	As of January 2009 MN GreenStar currently had 11 completed certified projects at different levels, including 5 new single-family home construction and 6 remodeling projects. There were 106 registered projects, including 33 from the pilot phase.	The NAHB had certified 103 homes nationally as of January 15, 2009.
Levels of Certification	Bronze, Silver, and Gold	Bronze, Silver, Gold, and Emerald
Types of Projects	MN GreenStar addresses new single-family home construction, renovation and additions. MN GreenStar addresses building sites and has been exploring the option of a Neighborhood Development Standard. Remodeling projects are prioritized within the MN GreenStar program and four types of remodeling are recognized (See Table 6).	The NGBS addresses new home construction (including single-family and multi-family), subdivisions, building sites, alterations, additions, renovations, and remodels, mixed-use residential buildings, and historic buildings where applicable. Remodeling projects are not prioritized within the NGBS program and online scoring is currently not available for the Green Remodel Path.

Program Element	MN GreenStar	NAHB NGBS
Prerequisites	88 mandatory prerequisite credits for Homes; 105 mandatory credits for remodeling. Not all of the prerequisites will apply to any given project.	22 mandatory requirements for new construction; 28 potentially mandatory requirements for remodeling projects using the Green Building Path, or 5 mandatory through Green Remodel Path
Environmental Categories	Energy Efficiency; Resource Efficiency (including durability); Indoor Environmental Quality; Water Conservation; and Site and Community Impacts	Lot Design, Preparation, and Development; Resource Efficiency; Energy Efficiency; Water Efficiency; Indoor Environmental Quality; and Operation, Maintenance, and Homeowner Education
Approach to Renovation, Remodeling and Additions	MN GreenStar began with a green remodeling standard. Under MN GreenStar Remodeling, there are four project types: renovations that do not add conditioned space, renovations that add conditioned space without changing exterior shell of building, renovations that change exterior shell of building but use only existing foundation, and renovations that add a foundation.	Renovation and addition notes are incorporated into the credits of the New Homes standard. A project is classified as a renovation or addition project if the project is less than 75% of the conditioned floor area.
Multi-family	MN GreenStar does not deal specifically with multi-family construction projects, although condos and townhomes can utilize the program on a per-unit basis.	Multi-family projects in the NGBS are addressed in a similar fashion to remodeling; multi-family criteria are attached via notations to new home construction credits.
Home Size Thresholds	The MN GreenStar program gives preference to smaller home sizes and provides a matrix for the number of bedrooms and the associated size (square foot) targets. This approach provides flexibility for users. For example for the New Homes program, a 1,950 square foot 3-bedroom house is considered "baseline" – 3-bedroom homes that are larger must achieve more points. The Remodeling system awards 20 points for projects that are less than 1,500 square feet total after renovations/additions.	Homes over 4,000 square feet are penalized - one additional point in each category is required for every 100 square feet over 4,000. Projects under 2,500 square feet are awarded points on a sliding scale.

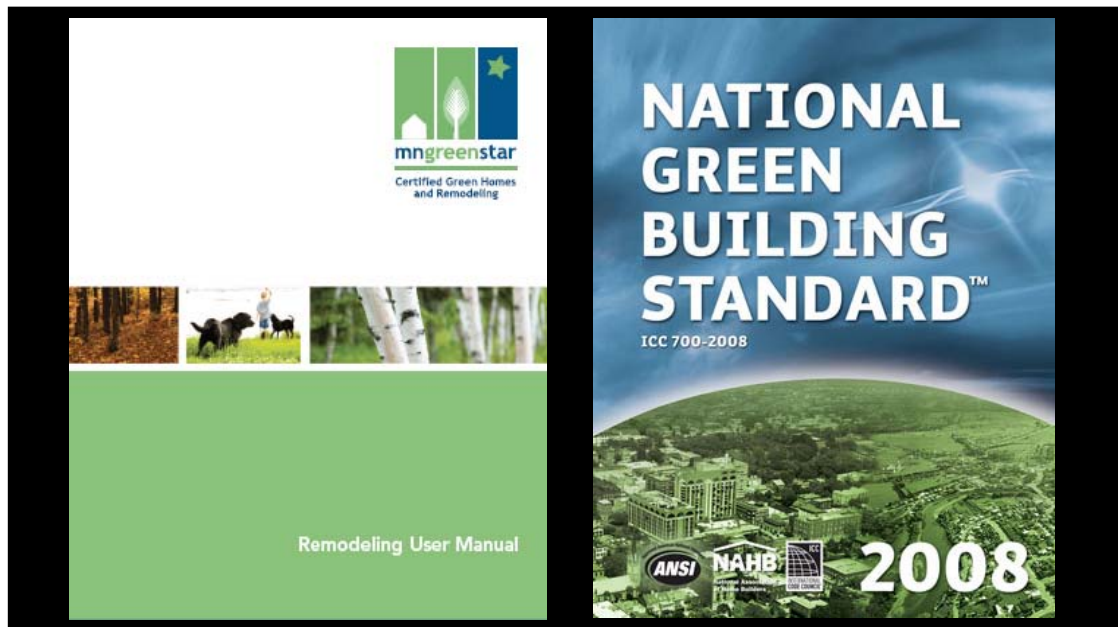
Program Element	MN GreenStar	NAHB NGBS
Certification Process	Mandatory training, project registration, checklist, pre-construction document review and approval, project inspection by third-party verifier, final submittal and review for certification	Online green scoring tool, accredited verifier inspection, pay fee, complete agreement and documentation, final inspection for certification.
Registration	Application and checklist available at website and can be submitted through mail or email	Online scoring tool completed online available for most programs. The online scoring tool is free to use.
Use of Verifiers	The MN GreenStar program uses raters to help verify the certification process, and currently has 5 MN GreenStar-approved rating companies.	The NGBS will now offer third-party certification by qualified verifiers. Verifiers are certified through the NAHB Research Center. As of mid-February, 2009 three accredited verifiers were working in Minnesota.
Fees	\$100-\$200 per project plus \$0.10 per sq. ft and \$350 for training	\$200 per building for NAHB members; \$500 for non-members. Additional \$20/unit for multi-unit projects.
Training Available	MN GreenStar offers two basic 8-hour classes, one for remodeling and one for new home construction. Approximately 350 local professionals have completed the training.	The NAHB University of Housing hosts the educational programs and professional designations for NAHB, including the Certified Green Professional (CGP) rating.
Training Requirements	The general contractor of the project must complete MN GreenStar training, and additional points are available in the project if the designer or subcontractors also take the class.	Being a Certified Green Professional (CGP) is not required nor does it garner points through the NGBS certification. NGBS has credits for using qualified professionals for testing.
Energy Standard	MN GreenStar requires that new homes have HERS ratings of 75 or less and gives points for achieving ENERGY STAR certification. For remodeling projects energy is rated on a percent improvement basis.	NGBS requires a minimum energy performance 15% over the IECC, and any building that at least achieves ENERGY STAR standards or equivalent can be certified to the Bronze level. The Green Remodel Path requires reductions in energy use.
Homeowner Education Manuals	Mandatory	Mandatory

Minnesota GreenStar Program and National Green Building Standard Comparison Report

Introduction

Green building standards play a key role in the “green” movement. Green building programs provide helpful tools and information about how to build green, offer insight to the environmental impacts of green building construction, and allow for growth and understanding in the building industry. Green building standards also create achievable benchmarks that mark excellence and offer incentives for future improvement. A quality green building standard that has the highest potential for reducing negative environmental impact will follow an upstream approach, attempting to address issues before they become problems and will not compromise integrity for ease of use to the builder. There are many different green building programs currently available in Minnesota, and each program has its own challenges and advantages.

The purpose and scope of this report is to compare the National Association of Home Builders (NAHB) National Green Building Standard (NGBS) and the Minnesota GreenStar New Homes and Remodeling standard, both of which are available in Minnesota. This report compares and contrasts the programs’ basic processes, general usability, and the environmental benchmarks that each program’s standard embodies. This report is based on the Minnesota GreenStar checklist and manual versions available as of January 1, 2009, which will be referred to as “MN GreenStar” for purposes of brevity. The National Green Building Standard version used for comparison in this report is the Second Public Draft version first released in December 21, 2007, and will be referred to as “NGBS”.



Program Overviews and History

Minnesota GreenStar Certified Green Homes and Remodeling

The Minnesota GreenStar Program first formed in 2005 through an ad-hoc committee called the Green Remodeling Group, with the purpose of being a green building standard that focused specifically on remodeling. The remodeling standard, one of the first in the country of its kind, was compiled with help from many different Minnesota-based companies and organizations², and the committee was awarded a grant from the Minnesota Pollution Control Agency (MPCA). A new home construction program was added with partnerships from the Builders Association of the Twin Cities (BATC) and the non-profit organization The Green Institute. The two programs officially became known as Minnesota GreenStar Certified Green Homes and Remodeling, and the organization achieved non-profit 501(c)3 status in 2008.

The MN GreenStar program was initially designed to be a green building standard that was “desirable, accessible and available to all.” Its intended participants are builders and remodelers, as well as architects and interior designers. Contractors, suppliers, and homeowners are also targeted through education services.

The MN GreenStar standard is governed by a 14-member Board of Directors. The board consists of nine seats that are appointed by the founding members (BATC, the National Association of the Remodeling Industry – Minnesota Chapter [NARI-MN], and The Green Institute), five that are nominated by committee and approved by the Board (including one seat by the Technical Committee), one by the Past President (temporary seat), one by a major utility, and two by a state agency/academic institution. The current board of directors includes representatives from BATC, NARI-MN, The Green Institute, the Center for Sustainable Building Research (CSBR), Building Knowledge, Xcel Energy, and the Minnesota Department of Commerce. Other committees in MN GreenStar are currently chaired by Board Members and have open enrollment for volunteers. At this time, committee volunteer members include builders, remodelers, architects, landscape designers, members of non-profit organizations, MPCA members, educators, suppliers, building science experts, and more. Each seat has a term of three years. Credit Interpretation Requests (CIRs) and Credit Revisions can be requested through the MN GreenStar website or directly to MN GreenStar and are approved by committee. All CIRs go through the Technical Advisory Committee.³

² Participants in the GreenStar Program formation included builders, remodelers, interior designers, architects, lumber yards, flooring distributors, building science professionals, MN Department of Commerce - Energy Office personnel, the University of Minnesota’s Center for Sustainable Building Research (CSBR), utilities, and the MPCA Green Building specialists, as well as members of BATC and National Association of the Remodeling Industry (NARI-MN).

³ Dovetail Partners supported the formation of the GreenStar program, and the lead author on this report currently serves on the Technical Advisory Committee.

NAHB National Green Building Standard

The National Association of Home Builders (NAHB) is a member-driven trade organization whose mission is “to enhance the climate for housing and the building industry.” The NAHB was officially formed in 1942 as a combination of the National Home Builders Association and the Home Builders Institute of America. The formation was initially created to serve as a voice for builders in response to harsh war-time restrictions in the home building sector. Today the NAHB continues to represent the home building industry’s interests on Capitol Hill and in the housing finance sector, and also offers education, economic and consumer trend reports, and other services to its members. Membership is now over 200,000 individual members, including over 800 state and local associations. One third of NAHB’s membership includes builders and remodelers, and the remaining two-thirds are industry-related. NAHB claims that over 80 percent of homes built in the US are by NAHB members. NAHB also offers international membership.

The NAHB has a staff of over 300 and over 2,800 members serve on the association’s Board of Directors, which is comprised of elected directors, Life Directors with voting rights, members of the Executive Board, State Representatives, Life Members of the Association with voting rights, and directors-at-large. The six Senior Officers of the Board are elected annually by the Board of Directors at the National Association of Home Builders meeting of the members, and include builders, developers, and housing lobbyists. Sixteen National Area Chairmen are elected by the Board of Directors to represent fifteen regional locations (fifteen area chairmen and one national chairman)⁴. Each state also has its own Representative whose role is to provide information to their National Area Chairman on local issues, which can then be conveyed to the Executive Board⁵. NAHB also has a number of councils and committees which address specific topics in the building sector.

The NAHB released the Model Green Homebuilding Guidelines (MGHG) in 2005. The guidelines were written by the NAHB Research Center and a Stakeholder Group of over 64 organizations, including builders, researchers, environmental experts, designers and other organization representing various vested interests in residential construction. They were intended to be used as a baseline for local Home Builders Associations (HBAs) to create their own standards and benchmarks. The program was also intended to be used by builders interested in green building products and practices for residential design, development, and construction. The initial release established guidelines for new home construction but did not address remodeling. The MGHG covers seven areas of Lot Design, Resource Efficiency, Energy Efficiency, Water Efficiency, Indoor Environmental Quality, Homeowner Education, and Global Impact. Three levels of green building - Bronze, Silver, and Gold are offered. The program received considerable criticism from design professionals who claimed the program was too focused on being easy for builders and not focused on good design and long-term sustainability. Participation in this program is voluntary, and can still be used today as a green building standard.

⁴ For example, Minnesota, Iowa, North Dakota, South Dakota, and Wisconsin are represented by Don Beal of Area 10

⁵ Michael McCalvy is the state NAHB representative for Minnesota.

In February 2007 NAHB announced that they would develop a new standard based on the MGHG called the National Green Building Standard (NGBS). The NGBS was prepared by a committee of industry stakeholders led by NAHB, the NAHB Research Center, and the International Code Council (ICC). It was developed through an American National Standards Institute (ANSI) consensus process, including public comment and reviews. The second draft went out for public comment on December 21, 2007 and closed on February 2, 2008. The second draft is the basis for this report, as it is the most recent public information available, and slight revisions may have been made since the close of the public comment period⁶. The NGBS was ANSI-approved January 29, 2009⁷.

In addition to many changes in credits and environmental impacts, the NGBS has a number of features beyond the MGHG. In addition to Bronze, Silver, and Gold levels, an additional Emerald level standard is available in the NGBS. The standard outlines not only single-family home construction, but also addresses developments, multifamily dwellings, renovations, and additions. While still a voluntary self-certification program, the NGBS offers third-party certification through accredited verifiers⁸ that are certified through the NAHB Research Center.

Program Processes

As of January 2009, MN GreenStar had 11 completed certified projects at different levels, including 5 new single-family home construction and 6 remodeling projects. There were 106 registered projects, including 33 from the pilot phase and some that are currently waiting to complete the certification process. All projects were located in Minnesota. As of this writing, two other Midwestern states were considering adopting the MN GreenStar for their own state green building program. Minnesota GreenStar addresses new single-family home construction, renovation projects and additions. MN GreenStar also addresses building sites and has been exploring the option of developing a Neighborhood Development Standard in the future.

The NAHB had certified 103 homes nationally as of January 15, 2009.⁹ More than 2,600 projects have been registered to use the scoring and design tool of NAHB green as of mid-summer 2008. The number of NAHB projects that have gone beyond the online registration step and paid the registration fee is not available. A pilot phase is not planned for the NGBS release, but an online beta-test of the scoring tool for the new program has been available and was being used prior to ANSI approval and full program release. The NGBS addresses

⁶ Results from the latest public comment period can be seen here:

<http://www.nahbrc.org/technical/standards/gbpublicreport.pdf>

⁷ The ANSI approval came during the final revision of this paper and changes were not able to be incorporated. http://www.nahb.org/news_details.aspx?sectionID=0&newsID=8533

⁸ <http://www.nahbgreen.org/Certification/becomeverifier.aspx#prereq>

⁹ This does not count the number of homes that were certified under local programs created from the MGHG by local HBAs.

new home construction (including single-family and multi-family), subdivisions, building sites, alterations, additions, renovations, mixed-use residential buildings, and historic buildings where applicable.

The program structures of both MN GreenStar and NGBS follow typical green building program protocol. The two programs both require fulfilling a set of mandatory prerequisites and attaining points through meeting additional green building criteria. Both MN GreenStar and NGBS require that a minimum number of points are attained in each Environmental Impact category, which is meant to ensure that the building will be green in all environmental categories, not just one. Point requirements differ between programs (see *Tables 2, 3, 5, 6, and 8*). One difference between the programs is that prerequisites in MN GreenStar do not count for any points, while certain mandatory requirements in the NGBS are eligible for points.

New Single-Family Homes

The MN GreenStar New Home program has 88 mandatory prerequisite credits (see *Appendix A*). Not all of the prerequisites will apply to a given project. After the applicable mandatory credits are completed, additional points are required in each environmental category. Environmental categories for the MN GreenStar program include: Energy Efficiency (EE); Resource Efficiency (RE) (including durability); Indoor Environmental Quality (IEQ); Water Conservation (WC); and Site and Community Impacts (SC)¹⁰. MN GreenStar credits are structured around the building process into eight components of the traditional building process – outdoor and site, building envelope and systems, mechanicals, electrical and lighting, plumbing systems and fixtures, finish materials and coatings, and waste management. Each credit is mapped to five environmental benefits it fulfills, and many construction tactics/credits have impacts in multiple categories. A range of different point totals achieves different levels of certification – Bronze, Silver, and Gold. The point threshold of the New Homes portion of the MN GreenStar standard is calculated based on house size (see examples in *Table 2*).

¹⁰ Like the NGBS, homeowner and builder education and project maintenance are also addressed, but are categorized differently in the GreenStar program.

Table 2, Sample of Minnesota GreenStar New Home Required Points for three different home sizes for a three bedroom home

MN GreenStar New Green Home Required Points Thresholds							
Project Type:	EE	RE	IEQ	WC	SC	Total	Certification Level
Points needed for a 3-bedroom 1,050 sq. ft. house*	70	39	40	25	40	218	Bronze
	109	62	65	42	65	371	Silver
	147	93	90	58	90	497	Gold
Points needed for a 3-bedroom 1,950 sq. ft. house*, considered baseline	90	50	40	25	40	255	Bronze
	140	80	65	42	65	420	Silver
	190	120	90	58	90	567	Gold
Points needed for a 3-bedroom 3,050 sq. ft. house *	107	59	51	36	51	285	Bronze
	165	94	76	53	76	467	Silver
	225	142	101	69	101	634	Gold

*sq.ft above conditioned space

The point thresholds for new homes under the NGBS program are listed in *Table 3*. The NGBS has 22 mandatory requirements (*Table 3*) and also requires additional points beyond those prerequisites in different categories. The categories for the NGBS are: Lot Design, Preparation, and Development; Resource Efficiency; Energy Efficiency; Water Efficiency; Indoor Environmental Quality; and Operation, Maintenance, and Homeowner Education. NGBS also requires additional points (either a total 50 or 100) beyond the points specified in each environmental category. These points can come from a combination of any environmental categories. The levels for certification range from Bronze, Silver, Gold, and Emerald.

Table 3, NGBS points required for new single-family home construction

NGBS Required Points per Category				
Category	Bronze	Silver	Gold	Emerald
Lot Design, Preparation, and Development	39	66	93	119
Resource Efficiency	45	79	113	146
Energy Efficiency	30	60	100	120
Water Efficiency	14	26	41	60
Indoor Environmental Quality	36	65	100	140
Operation, Maintenance, and Homeowner Education	8	10	11	12
Additional Points from any category	50	100	100	100
Total	222	406	558	697

Table 4, NGBS New Home Mandatory Requirements

NGBS New Single-Family Home Prerequisite Credits			
602.3	Foundation drainage	901.3	Garages
602.6	Finished grade	901.4(1)	Structural plywood & OSB
602.9	Water-resistive barrier	901.5	Carpets
602.1	Ice barrier	902.1	Spot ventilation
701.3	Third-party review	902.3	Radon control
701.4.1	HVAC systems	903.1	Tile backing materials
701.4.2	Duct systems	903.2	Capillary breaks
701.4.3	Insulation and air sealing	903.3	Crawlspaces
701.4.4	Fenestration	903.4	Moisture control measures
801.6(4) or 801.2.2(3)	Toilets and urinals	903.6	Duct insulation
901.2	Fireplaces and fuel burning appliances	1001.1	Builders owner's manual for one- & two-family dwellings

In addition to requiring points for the structure itself, the project site can also achieve certification in the NGBS at different levels for incorporating green lot design and development techniques. These levels range from One to Four Stars (*Table 5*).

Table 5, NGBS Site Design and Development Point Requirements for sites with New Homes

NGBS Site Design and Development Point Requirements for sites with New Homes				
Category	One Star	Two Stars	Three Stars	Four Stars
Site Design and Development	79	104	134	175

Remodeling

In direct contrast to the NGBS which began as a new home standard and then was expanded to include remodeling, the MN GreenStar Program began as a green remodeling standard in an effort to specifically address only renovations and additions. The MN GreenStar New Home standard is a separate program that was adapted from the Remodeling standards. Under MN GreenStar Remodeling, there are four project types, including renovations that do not add conditioned space; renovations that add conditioned space without changing exterior shell of building; renovations that change exterior shell of building but use only existing foundation; and renovations that add a foundation. The MN GreenStar Remodeling program has 105 mandatory credits (*Appendix B*), and additional points are required to achieve minimum certification levels and beyond (see *Table 6*). Not all of the mandatory credits will apply to a given project, and the applicable prerequisites will depend upon the specific project scope. Remodeling projects with a small total square footage size gain extra points.

Table 6, Minnesota GreenStar Remodeling Required Points

MN GreenStar Remodeling Required Points Thresholds								
Project Type:		EE	RE	IEQ	WC	SC	Total	Certification Level
1	Renovations that do not add conditioned space	86	28	23	8	7	165	Bronze
		106	36	26	15	20	215	Silver
		122	43	30	18	28	255	Gold
2	Renovations that add conditioned space without changing exterior shell of building	104	44	25	12	8	205	Bronze
		115	51	36	16	25	255	Silver
		144	58	46	26	34	320	Gold
3	Renovations that change exterior shell of building but use only existing foundation	127	56	41	14	21	270	Bronze
		139	61	46	18	31	305	Silver
		160	70	51	28	43	365	Gold
4	Renovations that add a foundation	154	60	42	14	35	315	Bronze
		172	68	48	19	49	370	Silver
		198	75	60	30	64	440	Certification Level

Renovations, remodeling, and additions are addressed in the NGBS as attachments to the existing New Home construction program. This method has led to complaints from remodelers and designers who believe that remodeling has a different set of challenges and needs that a new construction standard cannot effectively address. This concern was expressed in the public comment report of the first draft of the NGBS, which included a 52-page document of comments relating only to remodeling (*see sidebar for examples*).

The NGBS responded to these comments with the following: “Renovation and Addition notes are incorporated into the body of this new standard for four reasons: 1) To facilitate concurrent development of criteria for existing homes in the time frame allowed; 2) To hold existing homes to a similar standard as new homes while recognizing the difficult compliance issues that existing homes may have; 3) To provide a more user-friendly format for the many contractors who do both remodeling and new construction projects so they do not need to switch back and forth; and 4) To create one document to maintain as opposed to creating many products that are difficult to keep current and compatible.”¹¹

In the NGBS, a project is classified as a Renovation or Addition project if it is less than 75% of the conditioned

Sample Public Comments on NGBS Draft relating to Remodeling

“Having the addition & renovation requirements interspersed through the document to me is very confusing as to what is actually required for remodeling. Suggest removing to a separate document or its own section of the standard. I believe the current format will be very confusing to the user.”

“We applaud the desire to include remodeling in the draft Standard, but believe that, at this point, insufficient guidance is provided with which to make the results meaningful and to protect the overall integrity of the Standard. For these reasons, we recommend deletion of this section until such time as greater guidance on remodeling can be provided.”

<http://www.nahbrc.org/technical/standards/Remodeling%20Comments.pdf>

¹¹ <http://www.nahbrc.org/technical/standards/Remodeling%20Comments.pdf>

floor area.¹² Additions of 75% or more must comply with the typical threshold points rating system. Renovation/Addition projects must meet mandatory requirements noted as applicable to Renovation/Addition projects, including pre-project performance testing. Some credits that are non-mandatory for new home construction become mandatory credits for existing homes, and vice versa. Some credits are identified as being applicable to Renovations, some to Additions, and some to both. Credits that do not note Renovations/Additions are meant to be fulfilled in the same manner as new construction. If a project includes both Renovations and Additions, the Additions notes should be followed; other Renovation/Addition projects should follow the notes for their project type.

There are two possible paths to follow for NGBS Remodeling projects. If the existing structure was built during or after 1980, the Green Building Path applies. If the building permit for the existing structure was issued prior to January 1, 1980, the builder has a choice of either the Green Remodel Path or the Green Building Path. The Green Scoring Tool currently does not have the capability to score and store Green Remodel Path projects for renovations, and projects must be scored offline. A seven-step process is outlined to support the offline scoring and includes hiring a qualified professional(s) to conduct an energy and water consumption audit and a verifier to review the before and after analysis to prepare a report and verify the standard has been met. In the Green Remodel Path, certification levels are not determined based on points. Instead, once five certain mandatory indoor environmental criteria are met¹³, remodeling projects incorporate green building practices that will improve building performance levels by at least 25% in the categories of energy efficiency and water efficiency from the initial performance test (see *Table 7*). No other optional measures are required or encouraged.

Table 7, NGBS Green Remodel Path Certification Level Performance Thresholds

NGBS Green Remodel Path Performance Thresholds				
	Bronze	Silver	Gold	Emerald
Increase in Energy and Water Efficiency	25%	50%	75%	100%

The Green Building Path comprises the majority of the NGBS program and standard, and is also the version used for New Home construction. There are 28 mandatory credit requirements for Renovations/Additions using the Green Building Path (see *Table 8*) including some optional new construction practices. Points required for certification are the same for New Home Construction Projects (*Table 3*), and any points awarded from the mandatory requirements can help toward the certification. Some New Homes mandatory criteria (e.g. site management) may not apply to small remodeling projects. While the written standard mentions this, the online Scoring Tool currently does not. According to the Green Scoring Tool, a remodeler should score the project as if it's New Construction, purchase a copy of the NGBS, review the Renovation notes in the standard, and add a

¹² As defined by IRC and calculated in accordance with ANSI Z765 aggregate area of an existing construction building. Dwelling unit size should use ANSI Z765, where only the conditioned floor area for stories above grade plane shall be included

¹³ Sections 901.1.1, 901.5, 902.1, 902.9(2), and 904.2.2

column to make manual written changes to the exported document in order to justify exclusion from the project.

Table 8, NGBS Mandatory Remodeling Practices under the Green Building Path

NGBS Mandatory Renovation/Addition Practices	
Green Building Path	
605.1	Construction Waste Management Plan
605.2	Properly handle hazardous waste disposal
602.9	Water Resistive Barrier (Additions and renovations where veneer and/or siding removed and replaced)
701.1	Minimum Energy Efficiency Requirements
701.4.1	Space heating and cooling system sizing
704.4	Duct System sizing
701.4.3	Duct System sealing (new construction portions only)
701.4.4	Building cavities not used as ducts (new construction portions only)
701.4.5	Insulation installation (new construction portions only)
701.4.5.2,	Various energy efficiency requirements (mandatory for Additions only)
701.4.5.3,	
701.4.5.4	
702 or 703	Building Energy Efficiency (Performance or Prescriptive Path)
704.2.2	Recessed lights (mandatory for Additions only)
801.1	Indoor hot water usage
901.1.1	Natural draft equipment separated from conditioned air
901.2	Fireplaces and Fuel Burning Appliances
901.3	Garage and air quality (mandatory for Additions only)
901.5	No carpet in Bathrooms
901.8	Use low VOC paint (mandatory only when home occupied during construction)
902.1	Minimum ventilation for bathrooms and kitchens
902.9	Separation of HVAC System During construction
903.2	Capillary breaks (mandatory for Additions only)
903.5 (1)	Materials with no visible mold
903.5 (2)	Walls not enclosed with high moisture insulation
903.6	Moisture content of subfloor/substrate (mandatory for Additions only)
903.7.1	Plumbing distribution lines not installed in exterior wall (new distribution lines)
903.8	Insulate HVAC ducts (mandatory for Additions only)
904.2.1	Replace unsealed combustion gas dryer vent (if existing)
1001.1	Builder Owner/s Manual

Multi-family

Multi-family projects in the NGBS are addressed in a similar fashion to remodeling; multi-family criteria are attached via notations to existing new home construction credits. All credits are achievable in the same manner unless otherwise noted. Points are allocated for an entire building rather than individual units, and each unit in the building must achieve the green building criteria for which points are awarded. If a credit allows for different point

amounts for different units within a multi-unit building, the fewer number of points are credited. The MN GreenStar program is currently not slated to deal specifically with multi-family construction projects, although condos and townhomes can utilize the program on a per-unit basis.

Program Usability

Green building programs are used by a number of different people that play different roles in a building project. This section addresses verifiers, the certification process, educational resources available, registration fees, and the general use of each program.

Certification Process

The steps for getting a project certified are outlined in *Tables 9 and 10* for MN GreenStar and NGBS, respectively. Both programs use raters/verifiers to authenticate green measures. Final certificates are approved and issued by MN GreenStar and the NAHB Resource Center. Recognizing that building projects can take many months (or even years) from the design to final construction, both programs offer mechanisms to modify the original project description and associated scoring, with the ease dependent upon the degree of project change.

Table 9, Minnesota GreenStar Certification Process

<i>MN GreenStar Builder Process for Green Home Certification</i>	
Step 1:	Attend mandatory training program
Step 2:	Register project by filing application form. Download manual and checklist online for free.
Step 3:	Complete required pre-project testing (radon, energy baseline) – remodeling only
Step 4:	Meet with project team, set project goals, design project and fill out checklist
Step 5:	Submit pre-construction plan review documents (checklist, construction documents, plans, erosion control plan, and waste management plan)
Step 6:	Meet with third-party verifier for an Independent Plan Review and preconstruction HERS index calculation – new homes only
Step 7:	Schedule pre-construction plan review with MN GreenStar
Step 8:	Pre-construction plan review (correct at meeting if possible) Bring: Site plan, construction documents, completed checklist, landscape plan, waste management plan, and any other documentation necessary before beginning construction
Step 9:	Correct/amend project scope, plan, checklist and resubmit to MN GreenStar
Step 10:	MN GreenStar approves checklist, plans, and pre-tests and authorizes construction
Step 11:	Obtain a building permit
Step 12:	Begin construction
Step 13:	Pre-drywall - framing and thermal bypass inspection by authorized third-party rater
Step 14:	Complete construction
Step 15:	Final project inspected by authorized third-party verifier
Step 16:	Submit necessary project documentation, test results, and final checklist
Step 17:	MN GreenStar reviews post-project checklist, test results, documentation, and certifies

Table 10, NAHB Certification Process

NAHB Builder Process for Green Home Certification

- Step 1:** The builder scores the home using the online Green Scoring Tool. (Note: Online scoring is not available for all projects, and the Green Remodel Path can not be scored online. The reference manual must be purchased for approximately \$35.00)
- Step 2:** Export final Designer's Report from Green Scoring Tool and save locally as an Excel file.
- Step 3:** As construction begins, select an accredited verifier.
- Step 4:** Forward Designer's Report to selected verifier and schedule rough inspection.
- Step 5:** Meet with verifier after rough inspection to sign off on Verification Report which will be sent to NAHB Research Center for review.
- Step 6:** Receive invoice for \$200 home certification fee for NAHB members (\$500 for non-members).
- Step 7:** Complete Program Participation Agreement and return to Research Center with required evidence of insurance. Documentation is included in a builder's application packet.
- Step 8:** Schedule final inspection with verifier and sign off on final Verification Report including certificate information.
- Step 9:** After final report review and receipt of the certification fee, the NAHB Research Center will issue the Certified Green Home certificate.

Registration

To register a project through MN GreenStar, the project leader downloads an application and a copy of the checklist in Excel format for free from the website. The completed application then can be mailed or emailed to MN GreenStar, along with necessary preconstruction documentation (erosion control plan, waste management plan, and construction documents).

Registration for the NGBS is first done through the online Scoring Tool. Once the checklist is completed online and exported to an Excel document, the builder is responsible for contacting an accredited verifier to participate in the project. The completed checklist can be submitted to NAHB Resource Center via email. At the time of this writing, the Green Remodeling Path of the NGBS is not available to be scored online but a copy of the completed checklist can be sent by the verifier via email. Manuals are not free, but are available for purchase for approximately \$35.00.

Verifiers

The MN GreenStar program uses raters to help verify the certification process, and there are currently 5 MN GreenStar-approved companies that can provide rating services. These raters have all participated in the development of the program/pilot of MN GreenStar and have extensive knowledge of building science specific to Minnesota. MN GreenStar is currently reevaluating the “rater/verifier/inspection” process, and plans to continue to work with inspectors whose services are independent from MN GreenStar.

The NGBS now offers third-party certification by qualified verifiers. Verifiers must meet eligibility requirements, including having one year of acceptable professional experience in home building as well as acceptable green building experience¹⁴, not being employed

¹⁴ Acceptable experience is outlined on this page: <http://www.nahbgreen.org/Certification/becomeverifier.aspx>

through an Home Builders Association, not verifying self-involved projects, accumulating continuing education hours, participating in training and then passing an accreditation test. Verifiers are certified through the NAHB Research Center. There are currently 3 accredited verifiers that work in Minnesota.

Certification Fees

The fees for MN GreenStar and NGBS are listed in the sidebar. Additional fees for raters, verifiers, and additional testing services vary and are not included.

Program Education and Resources

Both MN GreenStar and NGBS offer educational resources and information to aid in the green building process (*Table 11*).

The MN GreenStar program offers education and resources for builders and strongly encourages homeowners and other project members to learn about green building as well. For example, in order for a project to become certified, the general contractor of the project must complete MN GreenStar training, and additional points are available in the project if the designer or subcontractors also take the class.

Program Fees

Minnesota GreenStar

Remodeling

Training \$350

Type 1 = \$100 + \$0.10 per square foot

Type 2 = \$100 + \$0.10 per square foot

Type 3 = \$150 + \$0.10 per square foot

Type 4 = \$200 + \$0.10 per square foot

New Homes

Training \$350

Certification = \$200 + \$0.10 per sq. ft.

National Green Building Standard

New Construction

\$200 per building for NAHB members

\$500 for non-members

Remodeling

\$200 per building for NAHB members

\$500 for non-members

Multi-unit building fee

Standard fees +\$20/unit

MN GreenStar offers two basic 8-hour classes: one for remodeling and one for new home construction. The training is open to all, including builders/remodelers that are not a member of any builder member organization. For example, a homeowner who has completed training can act as the general contractor of his or her home remodeling project. The class is eligible for eight Minnesota CEUs including one energy CEU, and MN GreenStar is currently in the process of assessing additional credit potential through the American Institute of Architects (AIA) and the Department of Revenue. The class is \$300 for members of BATC/NARI/BAM/ASID/AIA/NKBA¹⁵ and \$350 for non-members. Approximately 350 local professionals have completed the training to date. Upon completing the program, the professionals can call themselves “Minnesota GreenStar trained” and are eligible to register MN GreenStar projects. According to the MN GreenStar executive director, additional educational offerings are planned for 2009, including a comprehensive curriculum to educate real estate and design professionals. More continuing education credits for builders and remodelers are also likely to be made available through other organizations in the future.

¹⁵ Builders Association of the Twin Cities/National Association of the Remodeling Industry/Builders Association of Minnesota/American Society of Interior Designers/American Institute of Architects/National Kitchen and Bath Association

In addition to educational classes, MN GreenStar also offers a manual for each of its programs that explain the details of each credit in the checklists. The manuals also explain the rationale behind each credit and give insight to why the credit is important from an environmental standpoint. By going through the checklist and the program, any project member will likely learn about why green building is important and how to do it. Both the checklists and manuals are available free of charge and can be downloaded from the website. MN GreenStar has local, in-state staff available to provide information about the

The MN GreenStar website¹⁶ offers many resources for a project manager who is going through the program, including a general overview of what it means to “build green”. The website lists MN GreenStar education and local training seminars not related to MN GreenStar, and links to important local websites that may assist in obtaining local building materials, local auditors and local contractors. The website contains a page that highlights specific certified MN GreenStar projects and helps homeowners understand why they should be going green when considering remodeling or building a new home.

Table 11, Comparison of Green Resources offered by MN GreenStar and NGBS
Green Resources Per Program

NGBS	MN GreenStar
Scoring Tool that tracks points and mandatory requirements	Checklist that tracks points and mandatory requirements
Manual available for purchase or Scoring Tool that defines some glossary terms	Free Manual that guides builders, defines credits & provides additional information
Educational Classes	Educational Classes
Website	Website
Videos & Tutorials	n/a
Links to Green Materials	Links to obtain local Materials
Links to NAHB Verifiers & how to become a verifier & Verification Resource Guide	Links to MN GreenStar Verifiers
Links to local HBAs (no link for MN)	Links to local builders, BATC, BAM, & other MN organizations
Links that highlight green projects	Links that highlight green projects
Hosts Own Green Building Conference	Participation in Green Building Conferences
n/a	Education for Homeowners/non-builders
Information for Builders	Information for Builders and Designers
Hotline	MN GreenStar has local/in-state staff available, including staff whose primary function is the certification process and is available for consultations and process assistance.
Certified Green Professional Accreditation	No professional accreditation available, but going through training qualifies as "Minnesota GreenStar Trained" and is mandatory

The NAHB also has resources and education about green building and the certification process, and focuses primarily on builders rather than designers or the general public. The

¹⁶ <http://www.mngreenstar.org/>

NAHB has a specific website¹⁷ dedicated to green building questions and resources, including the Scoring Tool. The website includes links to verifiers, local HBAs, the MGHG and NGBS, and educational course for industry professionals. The NAHB also provides a Verifier's Resource Guide online to give guidance on what to look for and when to award points during the rough and final inspections of homes submitted for certification. Most information is available to the public, although some information is only open to NAHB members. Education is wholly dedicated to builders and not the general public.

The NAHB University of Housing hosts the educational programs for NAHB, including the Certified Green Professional (CGP) rating course. In addition to the two-day "Green Building for Building Professionals" course, a builder must also either take the "Business Management for Building Professionals" one-day course, or hold a previous NAHB designation. The prices for courses differ per location, but the "Green Building" course in Minnesota is \$400 for members/\$450 for non-members and the "Business Management" course is \$200 for members/\$225 for non-members. In addition to the classes, a CGP must have a minimum of two years of building industry experience and agree to adhere to the CGP Code of Ethics. A CGP must pay fees to graduate (\$145 for members/\$245 for non-members) and must also pay annual renewal fees (\$50 for members/\$75 for non-members). To maintain the CGP designation, a minimum of 12 continuing education hours is required over three years, 6 coming from NAHB University of Housing and at least 8 related to the green building industry. Being a CGP is not required, nor does it garner points, through the NGBS certification program.

The NAHB provides a hotline¹⁸ to answer questions, address comments, and provide resources to professionals looking to build green, and NAHB hosts an annual National Green Building Conference and expo known as the International Builders' Show (IBS).

NGBS resources are found primarily online, although at the time of this report a complete online version of the NGBS cannot be found free of charge (although public draft versions are available). Hardcopy copies of the standard are available for purchase through builderbooks.com for \$31.95 for members/\$35.95 for non-members.

Using the Programs

An ongoing debate among proponents of various green building programs has to do with their "usability". Typically this refers to how easy a program is to use, but can also refer to how often a program is used, who it is used by, or the impact the program has once it has been used. Because different people play different roles in a project and "usability" is often a personal preference, this report considers the general aspects of using each program from the point of view of a person who is trying to build their project through the program. It is important to keep in mind that green building is a new integrated upfront approach to building that utilizes both old and new building practices and is unlikely to be "easy" while

¹⁷ <http://www.nahbgreen.org/>






¹⁸ NAHB National Green Building Program Hotline. 877-NAHB-GRN (877-624-2476). The Hotline is available from 9:00 AM - 5:00 PM Eastern time.

the industry is learning. Green building certification is a process of setting a bar for high-quality performance, and documentation and verification are necessary steps.

The MN GreenStar and NGBS programs are distinct in that the first is a regional program that utilizes regional building practices while the other is national in scope and beholden to providing a standard that has broad applicability.

The MN GreenStar program currently uses an Excel spreadsheet checklist for builders to self-score their projects (*Figure 1*). Project managers download the checklist and manuals for free from the website and begin by checking through the building practices typically done on their projects. The checklist is arranged in the order a builder would create a project, and begins with the mandatory prerequisites. Prerequisites are already marked with a “Y” so that they will always be shown on the checklist. Then the form guides the user through organizing an integrated project team and choosing a sustainable site, to designing the building from the foundation through to selection of finishes.












Figure 1, Minnesota GreenStar Checklist example

 MN GreenStar New Homes Checklist VERSION 1.0 05/05/08								<input type="checkbox"/> SUMMARY VIEW <input type="checkbox"/> SELECTION VIEW	
LINKED SYSTEM	PROJECT NUMBER:		SF:		POINTS CATEGORIES				
	CHOOSE "Y" TO SELECT	ID NUMBER	DESCRIPTION					TOTAL	
				EE	RE	IE&R	WC		SC
GRAND TOTAL:				77	79	31	143	65	395
Y		5D --5	Install hydronic in-floor heating system connected to heat source that has at least 80% AFUE boiler. Connecting to ground source heat pump or hot water solar systems also qualify.	4	2	2			8
		5D --6	Furnace is equipped with an electronically commutated fan motor (ECMs) -- (variable speed motor)	1					1
		5D --7	Air conditioner refrigerant is HCFC alternative					3	3
		5D --8	Verify proper refrigerant charge by HVAC contractor	1					1
		5D --9	House does not have A/C system and designed to provide passive cooling.	11	5	4		2	22
		5D --10	Measured airflow of new equipment within 10% of manufacturer's specifications	2					2
		5D --11	Establish interruptible service for air conditioner with electric service					2	2
		5D --12	Install an aquastat control (for hot water boilers only)	2					2
		5D --13	Install a Time-Delay Relay (for hot water boilers only)	2					2
	IN CHECKLIST / 2DR.1 / 2DR.2 / 3E.1 / 4E.12 / 5R.1 / 6DR.1 / 11A.7 / internal /								

The checklist contains all of the information a builder needs on one document, starting with Credit ID Number and Description, and includes the number of points allocated per environmental category for that credit. It also provides the type of documentation required for each credit, and whether the documentation must occur during construction and/or pre-drywall (see *Figure 2*). Although the MN GreenStar checklist appears lengthier than the NGBS, the number of criteria for each of the two programs is proportionate.

The MN GreenStar checklist is designed for a builder and his or her design/building team to go through together to decide which green building strategies will be incorporated in the project, and give that credit a “Y” in the left column. The checklist automatically begins to tally the points for each category. The number of points per category and the total number of points for the project are always found at the top of the checklist, and can also be seen at the headers of the start of each new category. At the bottom of the checklist is a table that summarizes the points for each building category and across each environmental category.

Figure 2, Minnesota GreenStar Documentation example

DOCUMENTATION FORMAT				REQUIRED DOCUMENTATION & SIGN OFF		
				Pre-Construction Plan Review Documentation	During Construction and/or Pre-Drywall Documentation	Post-Construction Documentation
				Notes on drawings and/or specifications indicating work to be done or product to use.	na	Mfr. documentation
				Notes on drawings and/or specifications indicating work to be done or product to use.	na	Mfr. documentation
				Notes on drawings and/or specifications indicating work to be done or product to use.	na	Post-installation photo ---OR--- rater check off
				Notes on drawings and/or specifications indicating work to be done or product to use.	na	Post-installation photo ---OR--- rater check off
						receipt, energy label
						rater verifies
						electrical contractor sign-off

The checklist includes documentation templates, a rain barrel calculator, an attic ventilation worksheet, and a waste management plan template. Some are partially completed to offer examples of how to get started. There is a search function of the entire document in order to location specific credits in the checklist around a specific material or technique.

The way the MN GreenStar checklist is viewed can be changed to improve ease of use. The “Summary View” shows only the summary of each building credit category. The “Selection View” shows only credits selected to be implemented in the project. When the builder has completed scoring the project, the Selection View can be used to focus on only the credits he or she is striving to achieve, and then print this for distribution to the project team, subcontractors, and rater.

Similar to going through the simplified Scoring Tool of the NGBS (more information below), the language in the MN GreenStar checklist is straightforward with respect to some principles but may need further explanation in others. The MN GreenStar manual offers detailed information for each credit and in some cases also suggests additional resources beyond the checklist (some resources are still listed in the manual as “TBD”). It is highly likely that builders that take a MN GreenStar educational course may benefit greatly, and that builders will quickly become familiar with the format after working on one project. A builder who is going through the MN GreenStar checklist may still have a few questions, and in some cases may not be able to find answers. For example, one credit specifies using a MN GreenStar Carbon Calculator, but such a calculator is not easily found in the checklist, manual, or website.

The MN GreenStar is currently going through a revision process, and is scheduled to release Version 2.0 in April 2009. The improvements will consider feedback from focus group studies, MN GreenStar affiliates, and program users. Some improvements include clickable links for each credit in the checklist to corresponding credit in the manual, more advanced viewing capabilities of the checklist, and a guide to teach builders how to use the checklist. The checklist will also show the total points needed overall and in each category to reach the desired certification level, in addition to showing the total number of points accumulated. Version 3.0 will likely include an online management system.

Participation in the NGBS begins with an online self-scoring process. The NAHB Green Scoring Tool is free to use, and after creating a user name a builder has his or her own account to log into at a later time. A builder then creates new projects, classifying each as either a single-family or multi-family project in the categories of New Construction, Renovation, Addition, or Renovation with Addition. All information can be changed at a later date. If a builder has many projects that are very similar, projects can be duplicated. Green Subdivisions and the Green Remodel Path are currently not available through the online scoring tool. These projects must be scored offline. A seven-step process is outlined to support the offline scoring projects under the Green Remodel Path for Renovation and includes hiring a qualified professional(s) to conduct an energy and water consumption audit and a verifier to review the before and after analysis to prepare a report and verify the standard has been made. For remodeling projects that are following the Green Building Path, in addition to using the scoring tool, a remodeler must purchase the NGBS manual, follow additional guidelines or exceptions based on their specific remodeling project. This may include creating a new column in the exported Excel file and manually writing additional information. New home projects can use the online Green Scoring Tool as it is.

Once a project's basic information is saved in the NAHB Green Scoring Tool, a builder can begin going through the checklist. The builder enters the square footage for each project, and if the square footage of a project requires obtaining more points, the point total is automatically recalculated. The builder selects a chapter from which to begin, from Chapter 5 to Chapter 10. Clicking on a chapter begins the scoring tool for that chapter, and also releases a drop-down menu that lists each of the credits. Mandatory credits are marked by a large "M". Clicking on a credit link opens a page that includes a credit description and number of points. Each credit also contains links for verification, intent, implementation, resources, and green approved products specific to that credit. By checking a box in a credit, points will be added to the score of the chapter and total project. Once one credit has been saved, the scoring tool automatically moves to the next credit until the chapter has been completed. Typically no more than three credits are seen on a screen at one time before the builder needs to hit "Save and Continue." While this breaks the checklist into bite-size pieces, this feature definitely takes some time, and could be potentially cumbersome for someone with a slow internet connection.

Figure 3, NGBS Scoring Tool Project Scoring Analysis example for a New Home Project

The Project Scoring Analysis provides an overview of the points achieved for your project, and allows you to see what points are necessary to reach each level of green building.

▲ Hide Bronze Scoring Analysis					
Chapter	Required Points	Claimed Points	Additional Claimed Points Above Bronze	Point Shortfall	Mandatory Status
Chapter 5: Lot Design, Preparation, and Development	39	73	34		Not Applicable
Chapter 6: Resource Efficiency	45	4		41	Met
Chapter 7: Energy Efficiency	30	89	59		Met
Chapter 8: Water Efficiency	14	21	7		Not Applicable
Chapter 9: Indoor Environmental Quality	36	0		36	Not Met
Chapter 10: Operation, Maintenance, and Building Owner Education	8	0		8	Not Met
SECTION TOTALS	172	187	100	85	
Additional Points Above Bronze	50	--	100	0	
TOTAL POINTS	222	187	--	85	

To achieve Bronze:

- Reach required Bronze score for each chapter
- Reach required [Additional Points](#) for this project
- Meet all mandatory items
- Select a minimum of 2 items from Section 704 or choose the Alternative Bronze Path in Chapter 7: Energy Efficiency.

The NGBS requires the purchase of a manual as a reference for completing the scoring process (the manual costs approximately \$35.00). Certain words are hyperlinked in the Scoring Tool with pop-up definitions that can lead to further information if needed. Along the way, explanations of what each credit entails, including hyperlinked definitions with further information, are included. The website also offers a Help section that includes glossary terms, explanations of common green building topics, and tutorial videos.

In addition to a Site Navigation and Chapter Navigation bar on the left, the Scoring Tool also includes a Chapter Summary and Project Summary at the bottom of the screen that show the total number of points per category and where the project is in terms of meeting certification levels.

Once the builder has checked the boxes of all of the credits the project will meet, the scoring tool provides a summary of points across all categories, including mandatory requirements that have not been met and points lacking in certain categories (see *Figure 3*). The builder can then choose to go back and adjust the plan to gain extra points, or if the desired level of certification has been achieved, a “report” can be printed of the project. This report can be exported in to an Excel spreadsheet that shows only the line items of the credits intended to be utilized in the project. It also includes documentation notes on each credit. See *Figure 4* for a screenshot example of this report.

Figure 4, NGBS Scoring Tool Project Report with Documentation Requirements

Practice 606.1 Biobased products	
Biobased products are used. 8 points maximum awarded.	
Total Points Claimed for this Item: 6	
2 types biobased materials used (separate from those claimed in 601.1(1)), each for >1% of project's projected building material cost	Points Claimed: 6
Documentation Required - List of biobased materials used including material cost of each, % of total material cost, and manufacturer's literature demonstrating biobase. Statement of total building material cost.	
Practice 606.2 Wood-based products	
Wood or wood-based products are certified to the requirements of one of the following recognized product programs:	
<ul style="list-style-type: none"> a. <u>AFF American Tree Farm System®</u> b. <u>Canadian Standards Association's Sustainable Forest Management System Standards (CAS Z809)</u> c. <u>Forest Stewardship Council (FSC)</u> d. <u>Program for Endorsement of Forest Certification Systems (PEFC)</u> e. <u>Sustainable Forestry Initiative Program (SFI)</u> f. other product programs recognized by PEFC 	
A minimum of 2 wood or wood-based products used for minor elements are certified to the requirements of a recognized product program.	
Conditions met	Points Claimed: 3
Documentation Required - List of certified wood product types used and literature or stamp showing certification.	
Major: _____	
Major: _____	
Minor: _____	
Minor: _____	

After a builder prints the project report, the next step is to find a NAHB verifier to negotiate rates and begin the registration/certification process (see *Table 10*). A tutorial to use the Scoring Tool is available online.

The NGBS does not have a fully functional search engine relating to the credits at this time, and because the manual is not available for free online, finding information relating to certain building techniques or materials can be cumbersome. For example, if a builder wanted to find information on the type of “carpet” to use and was not going through the Scoring Tool at that time, he or she would have to know that it fits into the Indoor Environmental Quality section and not the Resource Efficiency section (where most of the building materials are located).

Program Content

In essence, the primary reason for having green building certification systems is to reduce negative impacts on the environment. Currently buildings use over 40% of the world’s energy, and their construction contributes to 40% of all landfill waste. Categories for addressing environmental issues in green building programs typically include site selection/community impacts, resource efficiency, energy efficiency, water efficiency, and indoor environmental quality. Both the NGBS and MN GreenStar address these, and also address the important green building issues of Builder/Homeowner Education, an Integrated Design Team, and Innovative Design.

This section of the report compares some specific and key elements of the programs. It is not possible to compare all elements of both standards; however, additional details are included in the appendices. In general, both programs address the key environmental impacts of building construction, occupation and use. The key differences can be characterized by the fact that the MN GreenStar program is a regional program that includes, and in some cases goes beyond, high local building standards (e.g., energy codes in Minnesota) while the NGBS is applicable nationwide and therefore designed to include regions and building markets that vary considerably. In some instances, the NGBS program specifically references the use of local codes where they exceed the standard, but does not provide assistance in locating information about local standards and codes.

The MN GreenStar program provides helpful references to local resources that can help with finding specific information. As described earlier, the continued distinction between the two programs is that MN GreenStar has written a remodeling standard from the viewpoint of remodelers while the NGBS program is strongly focused on new home construction with even the remodeling scoring process relying upon the new home standards.

Integrated Design and Project Team

Simply addressing environmental issues on an individual basis is not enough to gain lasting impact. By using an integrated design process, different building aspects that are related can give and take from each other. For example, installing extremely energy-efficient windows may reduce the needed size of an HVAC system, and allow extra money to go toward those high-quality windows.

The MN GreenStar program awards points for an integrated design team, specifying that all subcontractors and even the homeowner should be involved in every design and pre-construction meeting. MN GreenStar also gives preference to conducting a post-construction meeting with the team to review performance and go over lessons learned. Additional expertise is rewarded in MN GreenStar as well; besides the mandatory training the builder is required to have, additional points can be achieved if the architect/designer has also completed the training program. MN GreenStar also gives points for demonstrating a systems design approach, such as coordinating the design of the ductwork around the framing. Design strategies like these can facilitate building construction, use less materials (and money), and be more energy-efficient.

The NGBS awards points for utilizing a team of professionals with well-defined roles that create a mission statement of goals and objectives for the project. In the site development portion of the NGBS, additional points are given for creating a checklist of green building measures to be incorporated into the site development (and following them), and a project can gain points if contractors are given training on the green building techniques they are about to implement into the project. This is not, however, referenced in the building component of the standard.

Site Selection/Community Impacts

The selection of a site, its relationship to the community, and its design, are important steps to building green. Choosing a location that is close to amenities and reduces transportation is one aspect of site selection. How the site is treated both during the construction process and post construction can have lasting impacts for homeowners and local habitats as well.

Both programs address using and cleaning up previously potentially contaminated sites, such as greyfields and brownfields. They also give preference to choosing a site that is close to public amenities and mass transit, and has connections to pedestrian walkways. Development density is specified in both programs as well, and both specify not building in protected habitats and providing opportunities to enhance biodiversity. MN GreenStar also gives preference to sites that are close to bike paths.

Both programs give preference to having a professional natural resource assessment and following up with a site/landscape plan. Slope assessment and soil erosion during construction are also addressed. Stormwater management issues are outlined in both programs, including using permeable pavers for hardscape. Both programs specify using native and drought-resistant landscaping, protecting vegetation during construction, keeping trees onsite (and reusing them), and taking advantage of vegetation and trees for passive solar heating and cooling. Both NGBS and MN GreenStar also suggest soil assessments and improving soil fertility and quality, and both give points for installing a compost bin for homeowner use. Both programs suggest participating in some sort of conservation program.

The NGBS contains a section that specifically addresses land development preparation for eventual construction of residential buildings or additions with its own rating system (see *Table 4*). Lands developed in this section earn a rating (in Stars) that is separate from any

certification earned by a structure that may eventually occupy the site. The MN GreenStar program does not have a separate rating system for land development, but addresses site-related specifics within the building standard itself. It is mentioned in the New Homes Manual that a Neighborhood Development standard is coming soon.

In addition to a specific land development section, the NGBS addresses some site-related green building considerations in the building construction section of the program. The MN GreenStar program also addresses site-specific issues in their program.

Both programs also address heat island effects by specifying light-colored materials or shading for hardscape. See *Appendix C* for NGBS site-related credits and *Appendix D* for MN GreenStar credits related to Site and Community Impacts, not including prerequisites.

Resource Efficiency

Resource Efficiency can include choosing materials that are responsibly or sustainably harvested or manufactured, recycled materials, and using less of them overall. It may also include diverting materials from the landfill by using materials that are durable or salvaged or constructed in a way that creates less waste.

Using less buildings material is the first step to resource efficiency. Both MN GreenStar and the NGBS base the amount of necessary points for certification on the square-footage of units.

The MN GreenStar program gives preference to smaller home sizes and uses a matrix to evaluate thresholds of acceptable amount of conditioned space (in square feet) per number of bedrooms.. This approach provides flexibility for the program's users. For example, in the New Homes program, a 3-bedroom house that is 1,950 square feet is considered "baseline"; 3-bedroom homes with fewer square feet can achieve less points to attain a given green rating, and homes that are larger must achieve more points. The MN GreenStar Remodeling system awards points for smaller house size as well, awarding 20 points for projects that are less than 1,500 square feet total after renovations/additions.

For the NGBS, homes over 4,000 square feet¹⁹ are penalized - one additional point in each category is required for every 100 square feet over 4,000. Projects under 2,500 square feet are awarded points on a sliding scale. For example, 15 points are given for units less than 1,000 square feet.

Reducing material consumption is also encouraged in both programs in other ways. Prefabricated and manufactured structures and advanced framing techniques can gain points and both programs award designing building dimensions to reduce material cuts. MN GreenStar requires that no use of 9-1/4" or greater dimension solid lumber in interior floor, wall or roof systems be used. The NGBS gives preference to materials that do not require additional finishing, painting, or staining on-site.

¹⁹ Only the conditioned floor area for stories above grade plane is included in these calculations.

Durability is stressed in both programs as well. NGBS suggests installing an ice barrier at roof eaves that is extended at least 24" inside the exterior wall line of the building in accordance with the IRC/IBC in areas where there has been a history of ice forming along the eaves. MN GreenStar specifies that back-primed wood siding and trim are preferred. MN GreenStar also gives points for installing a "lifetime roofing material", including slate, steel, concrete, and clay.

Both MN GreenStar and NGBS also address using environmentally preferable materials, including recycled-content materials, rapidly renewable materials, manufactured materials, bio-based materials, local materials, materials with both structural and insulation properties, and salvaged materials. Responsibly-harvested wood is also preferred in both programs – MN GreenStar prefers FSC only while the NGBS accepts American Tree Farm System, CSA, FSC, PEFC, and SFI. MN GreenStar does not allow vinyl wall coverings, even in moisture-rich areas such as bathrooms, kitchens, and laundry rooms.

Both programs give points for reusing existing buildings and for incorporating aspects into the project that make it more durable, including flashing, waterproofing, wicking prevention, and overhangs. Incorporating a waste management plan is a big part of both programs, and both programs give extra points for providing recycling bins for the homeowner as well.

Both programs give points for selecting the more environmentally preferable products based on utilizing a LCA tool. The NGBS gives points for conducting a whole building LCA analysis. See *Appendix E* for NGBS site-related credits and *Appendix F* for MN GreenStar credits related to Resource Efficiency and Durability, not including prerequisites.

Energy Efficiency

When most people think of green building, the first thought that comes to mind is energy efficiency. In Minnesota, this is an especially important aspect. Both programs address energy efficiency by offering paths to improve existing buildings and for new construction, and both require a third party energy review.

NGBS requires energy performance to be at least 15% over the International Energy Conservation Code (IECC), and any building that at least achieves ENERGY STAR standards or equivalent can be certified to the Bronze level in the Energy Efficiency category.

MN GreenStar requires that new homes achieve a HERS score of 75 or lower (the lower the HERS score, the tighter the building) and offers 10 points for a project that becomes certified through the ENERGY STAR Home program. Remodeling projects are based on energy improvement. MN GreenStar also requires that salvaged exterior doors be weather-stripped or air sealed appropriately.

Both NGBS and MN GreenStar offer many strategies for achieving energy efficiency, and both give points for utilizing various types insulation in many capabilities. Both programs

specify that wet blown insulation should dry properly before installing wall finishes and/or vapor barrier. MN GreenStar also requires that existing insulation in remodeling projects in exterior walls is greater than R19 or is brought up to at least this level (current Minnesota code). MN GreenStar also requires that all new crawlspaces be conditioned spaces, while NGBS does not. Both programs relay the importance of insulation and use of a continuous air barrier for an attached garage. The MN GreenStar program gives preference to installing double gasket-sealed doors between the home and the garage to improve energy efficiency.

Both programs recommend sizing HVAC equipment through ACCA Manual J. MN GreenStar also gives a large number of points for projects that contain no Air Conditioning unit at all and instead incorporate passive solar cooling techniques.

Both NGBS and MN GreenStar specify that unconditioned spaces²⁰ cannot be used for ducting, proper of sizing heating/cooling equipment, and sealing ducts, attic spaces, and openings to unconditioned spaces properly. They also go into great detail about sealing around windows, doors, skylights, joists, recessed lighting, around electrical boxes and fixtures, and other architectural features. MN GreenStar gives extra points for not installing any recessed lighting fixtures. Both MN GreenStar and NGBS specify proper insulation techniques for foundations, crawlspaces, and basements, and MN GreenStar especially highlights the risks associated with finishing basements and offers specific solutions.

MN GreenStar requires ENERGY STAR appliances as a mandatory requirement, while NGBS offers points for installing them. MN GreenStar gives points for installing other ENERGY STAR-rated products including, fixtures, ceiling fans, exhaust fans, lighting package, windows, cool roofing systems, steel-siding coating, light tubes, and dehumidifiers. NGBS gives points for windows, skylights, ceiling fans, appliances, fixtures, programmable thermostats and ground source heat pumps that are ENERGY STAR rated or equivalent. MN GreenStar also gives points for installing a clothesline and cutting back the need for a clothes dryer.

NGBS and MN GreenStar also give preference to using energy modeling to design the building and to passive solar heating/cooling. They also give preference to using CFLs or LEDs, and utilizing solar hot water or other renewable or highly energy-efficient methods of heating water or the home. The NGBS gives points for installing a device that provides monthly consumption information and/or a device that provides near real-time energy consumption data. See *Appendix G* for NGBS site-related credits and *Appendix H* for MN GreenStar credits related to Energy Efficiency, not including prerequisites.

Water Efficiency and Conservation

Water use is usually the area in green building programs that gets the least amount of attention in comparison to its importance. Both MN GreenStar and NGBS recognize the importance of water efficiency in their standards.

²⁰ Unconditioned spaces are spaces that are not thermally conditioned for the occupants of the building. Conditioned spaces are enclosed, insulated and sealed spaces.

Both programs specify using ENERGY STAR appliances and low-flow fixtures to conserve water. Both standards also give points for composting or waterless/composting toilets in the house, and MN GreenStar gives extra points for having a composting toilet onsite during construction. NGBS recommends installing water filters for the whole house. Installing a water shut-off valve and minimizing the length of piping hot water must travel in the home are also preferred by both programs.

The MN GreenStar program requires creation of a water conservation plan prior to construction, and NGBS gives points for making one but it is not required. Both programs give points for incorporating rain barrels, greywater irrigation systems, irrigation systems according to US Environmental Protection Agency's WaterSense standards, using moisture controls and timers, zoning turf and beds separately, planting native landscaping, and hydrozoning (grouping plants with similar watering needs together).

The biggest difference between the programs in terms of water efficiency is that NGBS gives points for installing a garbage disposal and MN GreenStar gives points for NOT installing one. See *Appendix I* for NGBS site-related credits and *Appendix J* for MN GreenStar credits related to Water Efficiency, not including prerequisites.

Indoor Environmental Quality

A big part of green building is providing a space that is healthy for the occupant. Part of this includes promoting practices of good indoor air quality inside the home. The NGBS and MN GreenStar both contain credits that help promote good Indoor Environmental Quality (IEQ).

One aspect to indoor air quality is the choice of materials installed in the home. Both programs specify products that contain no added urea-formaldehyde (MN GreenStar requires that all insulation is formaldehyde-free), and adhesives, sealants, and paints that have little to no VOCs are also preferred. Carpet that meets the Carpet and Rug Institute's Green Label Plus program are specified for both programs. NGBS specifies that carpeting should not be installed adjacent to toilets and bathing fixtures, while MN GreenStar additionally suggests carpet to not be installed in kitchens, entryways, and utility rooms, and gives additional points for installing no carpet at all.

Ventilation and reducing the introduction of outside hazardous materials into the home is important to both programs. Both the NGBS and MN GreenStar programs relay the importance of insulation and a continuous air barrier for an attached garage, and they both give extra points to having detached garages or carports. MN GreenStar even requires that remodeling projects can only build a new attached garage if an attached garage already exists, and insists on breezeways/mudrooms if a new one is built.

Both programs require carbon monoxide alarms outside of central sleeping areas and specify that bathrooms and kitchens should be vented to the outdoors unless a mechanical engineer suggests otherwise. Both programs give preference to installing ENERGY STAR

exhaust fans in bathrooms, and MN GreenStar gives extra points for low-Sone fans, which are quieter and are less likely to be unplugged by the home occupant. Both programs have prerequisites addressing proper ventilation of fireplaces. Both programs also specify taking proper measures to reduce mold growth, including installing humidity sensors and dehumidification systems.

Both MN GreenStar and NGBS require that wood-burning fireplaces should be equipped with gasketed doors designed to operate with doors closed, outside combustion air supply, and a means of sealing the flue to minimize interior air (heat) loss when not in operation (this also applies to any fuel-burning stove in the NGBS). Both programs also specify that factory-built, wood-burning fireplaces shall meet the certification requirements of UL 127 and shall be EPA Certified. NGBS specifies that natural gas and propane fireplaces which are power vented or direct vented shall have permanently fixed glass fronts or gasketed doors, and comply with ANSI Z21.88/CSA2.33 or ANSI Z21.50/CSA 2.22.

MN GreenStar specifies that new wood stove and fireplace inserts must be EPA certified and meet certification requirements of US 1482, Section 3.8, while NGBS specifies that they shall meet the emission requirements of the EPA Certification and the Washington State Certification. MN GreenStar specifies that new masonry heaters must meet the definition of ASTM e1602 and the IBC 2112.1. MN GreenStar gives additional points for not installing decorative fireplaces or stoves or removing them in remodeling projects (including wood, gas, electric, and biomass).

Ensuring that the home or site is not contaminated is one step to good IEQ. Both MN GreenStar and NGBS require radon testing done for existing homes, installing passive radon systems in new homes, and require radon mitigation if needed. MN GreenStar also requires a basement risk assessment and Calcium Chloride Test before finishing a basement. See *Appendix K* for NGBS site-related credits and *Appendix L* for MN GreenStar credits related to Indoor Environmental Quality, not including prerequisites.

Operation, Education, and Homeowner Education

Both programs have mandatory requirements for homeowner education manuals that explain green features of the project. As mentioned previously, only MN GreenStar requires that the general contractor complete a MN GreenStar green building training course prior to construction. Both give points for additional knowledge on the team; NGBS has credits for using qualified professionals for testing and MN GreenStar gives additional points for contractors, designers, or homeowners that also take the MN GreenStar green building training.

Summary

The National Green Building Standard and MN GreenStar both have potential for successful projects in Minnesota. Both programs address important environmental standards and offer educational seminars, websites and tools to help builders understand the process of certification and the importance of green building. To support education services, the NAHB has a fully developed website specifically dedicated to green building practices.

Both programs function effectively in terms of providing information for builders on documentation and registration requirements for project certification. NAHB focuses education services on a builder audience, while MN GreenStar includes builders as well as homeowners and other project partners in their education programs.

One of the strengths of the NAHB program is an online scoring tool that functions well when scoring the project in a linear fashion, and the associated table of contents allows the user to move through the standard as needed. The NGBS has improved credits relating to environmental impacts since the Model Green Homebuilding Guidelines (MGHG) were first developed. It should also be mentioned that the NAHB has achieved ANSI accreditation for their National Green Building Standard (NGBS), the first green building program in the United States to achieve this credential.

The leading strength of the MN GreenStar program is that it is a regional standard that is specific to building codes and conditions in Minnesota. The MN GreenStar program is also unique in providing a remodeling standard that is highly focused on the needs and conditions of remodeling projects. In contrast, the remodeling program within the NAHB program requires users to use the new home standard to evaluate renovation projects. The MN GreenStar checklist follows the natural order of a building project, has a strong sense of how remodeling projects work, and provides credits that are specific to regional issues in Minnesota. The MN GreenStar program provides free downloadable manuals and there are fully functioning searching capabilities in its checklists.

Both programs demonstrate opportunities for improvement. A few of the places where the NGBS program could be enhanced include addressing the fee associated with the required purchase of a manual, improving access to what is now members-only information, revising the credit structure and scoring tool to more closely follow a typical building process, changing the remodeling standard so that it is less strongly based on new construction practices, and improving the searching capabilities within the online scoring tool. The online scoring tool also may not be the best choice for builders in rural communities or those working without a high-speed Internet connection. For MN GreenStar, the quality of information in the manuals is inconsistent in terms of the level of detail and guidance that is provided for some sections, and the checklist navigation can seem confusing to a new user or someone unfamiliar with the program. MN GreenStar currently does not offer an online scoring method.

With all green building standards, going through the process with a first project will answer many questions and familiarize the user with the program and its operational details. The NGBS and NAHB are still working out the full functionality of the scoring tool and plan to announce new features in the second quarter of 2009. MN GreenStar released Version 2.0 in April 2009, which is intended to address many of the areas for improvement, and future enhancements to the program are planned to include online scoring capabilities. In the meantime, Minnesota has strong programs to choose from that can help increase participation in green building, whether it is new home construction or remodeling.

References

Builders Association of the Twin Cities. <http://www.batconline.org/index.aspx>

Minnesota GreenStar Certified Green Homes and Remodeling.
<http://www.mngreenstar.org/>

Minnesota GreenStar Education. <http://www.mngreenstar.org/education.html>

Minnesota GreenStar Certification Process. <http://www.mngreenstar.org/process-remodeling.html>

Minnesota GreenStar Checklist and Manual. <http://www.mngreenstar.org/certification-download.html>

Minnesota GreenStar History. <http://www.mngreenstar.org/about-who-we-are.html>

Minnesota GreenStar Raters. <http://www.mngreenstar.org/ed-resources.html>

NAHB Education.
http://www.nahb.org/meeting_search.aspx?viewAll=1§ionID=141&courses=1

NAHB History. http://www.nahb.org/NAHB_History/index.html

NAHB National Green Building Program Website. <http://www.nahbgreen.org/>

NAHB National Green Building Standard (NGBS).
<http://www.nahbgreen.org/Guidelines/ansistandard.aspx>

NAHB National Green Building Standard update.
<http://www.nahbrc.org/technical/standards/greenbuilding.aspx>

NAHB National Green Building Conference.
http://www.nahb.org/conference_details.aspx?conferenceID=59§ionID=120

NAHB International Builders Show. <http://www.buildersshow.com/Home/>

The National Green Building Standard™ Notification. NAHB Press Release. February 9, 2007. <http://www.nahbrc.org/technical/standards/gbinvitation.aspx>

NAHB Applauds ANSI Approval of National Green Building Standard™. NAHB Press Release. January 29, 2009.
http://www.nahb.org/news_details.aspx?sectionID=0&newsID=8533

NAHB Green Home Certification Process.

<http://www.nahbgreen.org/Certification/homecertification.aspx>

NAHB Model Green Homebuilding Guidelines.

<http://www.nahbgreen.org/Guidelines/nahbguidelines.aspx>

NAHB Public Comment Period Report.

<http://www.nahbrc.org/technical/standards/gbpublicreport.pdf>

NAHB Remodeling Comments from Draft #1.

<http://www.nahbrc.org/technical/standards/Remodeling%20Comments.pdf>

NGBS Renovation Steps.

<http://www.nahbgreen.org/GreenStandard/Standard/CreateProjectWizard.aspx>

NGBS Scoring Tool.

<http://www.nahbgreen.org/ScoringTool.aspx>

NAHB Research Center.

<http://www.nahbrc.org/>

Home Builder's Institute.

<http://www.hbi.org/>

NAHB Certified Green Professional.

<http://www.nahb.org/generic.aspx?sectionID=1420&genericContentID=88083>

National Association of the Remodeling Industry – Minnesota Chapter.

<http://www.narimn.org/index.html>

PERSIST method.

<http://www.homeenergy.org/archive/hem.dis.anl.gov/eehem/99/991108.html>

APPENDIX A: MN GreenStar New Home Prerequisites

MN GreenStar New Home Prerequisites	
OPR--1	Register with MN GreenStar and attend mandatory 8 hour contractor training
OPR--2	Submit all required documentation for a plan review prior to start of construction
OPR--3	All imported hardwood and softwood, except from Canada, must be FSC certified
OPR--4	Mechanical ventilation of home for 48 hours after project completion and prior to occupancy
OPR--5	Minimum of one approved and fully operational carbon monoxide alarm installed within ten (10) feet of each bedroom.
OPR--6	All combustion equipment must be sealed combustion (preferred) –OR-- direct vented
OPR--7	All projects must pass Fresh Air Supply (FAS) and Worst Case Combustion Spillage (WCCS) tests at end of the project.
1B--PR1	Home Energy Rating System (HERS) index of ≤ 75
3PR--1	Site plan that locates natural resources
3PR--2	Erosion control plan
3PR--3	Water conservation plan
3PR--4	Landscape plan promotes water absorption and minimizes soil disturbance
3PR--5	No invasive species, as determined by the MN Extension Agencies, are planted . Existing species are removed.
3PR--6	No cypress mulch
3PR--7	Following construction completion, no part of the disturbed site is left uncovered or destabilized
3PR--8	No railroad ties or other landscape materials may be used which contain creosote, chromated copper arsenate, or alkaline copper quaternary
4PR--1	Home meets existing MN Energy Code Requirements
4PR--2	If choosing to finish a basement, perform thorough risk assessment of existing conditions and systems prior to doing basement finish work.
4PR--3	Use Integrated Pest Management (IPM) methods to minimize pest entry.
4PR--4	Structural plywood conforming to PS1 and PS2 and oriented strand board (OSB) shall be made with exterior-type adhesives.
4PR--5	Credit number not used
4PR--6	No use of 9-1/4" or greater dimension solid lumber in interior floor, wall or roof systems. (Use 2x8s or smaller in exterior decks as much as possible).
4PR--7	If recessed light fixtures are being added or replaced where they penetrate into the unconditioned area of the attic, then new fixtures must be installed to prevent air and thermal leakage.
4PR--8	Any installation of salvaged doors or windows in an exterior application must be weather stripped, or air sealed with appropriate gasket.
4PR--9	Isolate attached garages: Install air barrier, seal common walls, ceiling and penetrations prior to insulating. Provide gasketed, self closing door to living spaces.
4PR--10	No power roof vents unless adequate air inlets exist. See also 5PR -- 7.
4PR--11	Obtain a copy of "FTC Fact Sheet" from the MN Energy Information Center for any type of insulation used on the project. This lists correct R-value for the insulation. (Metro 651-926-5120 or State wide 1-800-657-3710.
4PR--12	Install wind wash barrier over exterior sheathing (shingle fashion) integrate window and door flashing
4PR--13	Sealed air barrier separating all conditioned from unconditioned spaces

4A--PR1	ENERGY STAR home performance testing by 3rd party rater including plan review, framing inspection, thermal bypass inspection, and blower door test
4A--PR2	Blower door test result of ≤ 0.25 cfm50 per sq. ft. of building enclosure.
4B--PR1	Install soil gas (a.k.a. radon) mitigation system in new basements and new crawlspaces
4B--PR2	Remember basement risk assessment and Calcium Chloride Test before finishing basement. See 4PR -- 2 for more details.
4B--PR3	Crawl spaces shall be conditioned (raised pier foundation with no foundation walls are exempt)
4B--PR4	Properly install class 1 or 2 vapor retarder on top of basement and/or crawl space soil or gravel. (minimum 12" lap)
4D--PR1	New window and door units must meet energy code.
4D--PR2	Windows and Glass doors must be ENERGY STAR and National Fenestration Rating Council (NFRC) labeled
4D--PR3	Flash windows and exterior doors with pan, side & head flashing. Integrate with wind wash barrier of wall.
4D--PR4	Air seal around outside of window and door units with low expansion foam insulation. (maintain drainage void at base of window)
4D--PR5	Connecting doors between living space and garage are self closing and ≤ 0.30 cfm/sq.ft. air leakage rating.
4E--PR1	Seal recessed light fixtures to drywall with gasket, caulk or foam and add air sealed foam box or dome at all locations where they penetrate into the unconditioned area of the attic
4E--PR2	Provide attic insulation thickness markers
4E--PR3	Provide attic information card
4E--PR4	If batt insulation is used to insulate knee walls, an attic-side air barrier is required.
4E--PR5	Step flashing & kick-out flashing required at all roof / sidewall locations
5PR--1	No mercury in thermostats, switches or equipment, except fluorescent lights are allowed.
5PR--2	No unvented combustion units, with the exception of kitchen-type cooking devices with exhaust ventilation
5PR--3	No equipment is permitted that intentionally produces ozone as a product rather than as an incidental by-product
5PR--4	All clothes dryers must vent to the outside. All venting must be smooth, rigid duct, and must terminate at least 10 feet from any air intakes and any air conditioning compressor.
5PR--5	Ducts must be protected until construction (including floor finishing) is completed (protect returns, intakes & air handling equipment)
5PR--6	No power roof vents unless adequate air inlets are installed. See also 4E-13 & 4E-14.
5PR--7	All ductwork must be sealed
5PR--8	New ducting MAY NOT use building cavities as a part of the duct work (i.e. CANNOT use panning of joist or wall cavities for air supply or return system)
5PR--9	All bath fan ducting that is in unheated space must be insulated to min R-8
5PR--10	All cooling and heating equipment must be installed with a programmable thermostat (must be programmed)
5PR--11	No air handling equipment installed in unconditioned spaces or garages
5PR--12	Wood-burning insert fireplaces require cold-climate combustion ventilation kit
5A--PR1	Design and install a whole-house ventilation system in accordance with SECTION N1104 MECHANICAL VENTILATION SYSTEMS of the (2007 proposed) Minnesota Residential Energy Code. If atmospherically vented appliances exist at the end of the project, home must pass a Worst Case Combustion Spillage test before occupancy.
5C--PR1	All flex duct pulled tight-no pinches
5C--PR2	All ductwork in unconditioned space insulated (attics = R-30 min.) (walls = R10 min.)

5C--PR3	No building cavities can be used as ductwork. (i.e. no panning of joist or wall cavities for duct supply or return)
5D--PR1	No direct expansion systems allowed
5D--PR2	Condensation drains into drain system not under slab
5E--PR1	Site-built wood burning fireplaces must have gasketed doors, outside combustion air supply, and a means of sealing the flue to minimize interior air (heat) loss when not in operation.
5E--PR2	Factory-built wood burning fireplaces must meet certification requirements of UL 127 and be EPA Certified (or meet requirements for sale under IPA's voluntary Clean-Burning Fireplace Program).
5E--PR3	Wood stove and fireplace inserts must be EPA certified and meet certification requirements of US 1482, Section 3.8.
5E--PR4	Pellet (biomass/agrifuel) stoves and furnaces must meet the requirements of ASTM E1509 or are EPA Certified.
5E--PR5	Masonry heaters must meet the definition of ASTM e1602 and the IBC 2112.1
6PR--1	New appliances must meet or exceed ENERGY STAR requirements
6PR--2	NOT USED
6PR--3	If recessed light fixtures are being added where they penetrate into the unconditioned area of the attic, then fixtures must be installed to prevent air and thermal leakage. See 4PR-7
6PR--4	Adhere to the National Electric Code (NEC) during installation of wiring.
7PR--1	Water plumbing fixtures : Code-compliant
7PR--2	Meet National Energy Policy Act (NEPA) standards for "Low-Flow"
7PR--3	Gas water heaters (tank and tankless) are power vented or sealed combustion
7PR--4	No supplies or drains in exterior walls
8PR--1	All imported hardwood and softwood, except from Canada, must be FSC certified
8PR--2	No luan
8PR--3	Suspended/Acoustical ceilings are made with recycled materials (at least 60% - recycled content may include slag wool, other mineral wools, cellulose and recycled ceiling tiles - non fiberglass)
8PR--4	No paper-coated drywall in shower or tub surround or other moisture-rich area
8PR--5	No vinyl wall coverings allowed in moisture-rich areas such as bathrooms, kitchens, laundry rooms
8PR--6	All new carpet must be CRI Green Label Plus or third-party certified as low-emitting
9PR--1	Waste management plan.
9PR--2	Prepare and post a job-site materials management and recycling plan By posting a job-site materials management and recycling plan the details of the plan are communicated, shared and reinforced with everyone on-site
9PR--3	No burying or burning of construction waste
9PR--4	Seal all ducts and air handlers to prevent contamination during construction.
9PR--5	No construction debris discarded and closed inside any wall assembly
10PR--1	Mandatory green education of homeowner at end of project (2 hour minimum)
10PR--2	Provide homeowner with a user's manual covering house maintenance and green features of home

APPENDIX B: MN GreenStar Remodeling Mandatory Prerequisites

Minnesota GreenStar Remodeling Mandatory Prerequisites

OPR--1	Register with MN GreenStar and attend mandatory 8 hour contractor training
OPR--2	Submit all required documentation for a plan review prior to start of construction
OPR--3	Submit two year's worth of utilities bills to MN GreenStar (One year prior to the project, and one year after the project)
OPR--4	ENERGY STAR (or higher efficiency) rated appliances.
OPR--5	Erosion control plan
OPR--6	Waste management plan.
OPR--7	All imported hardwood and softwood, except from Canada, must be FSC certified
OPR--8	No mercury thermostats (remove/replace if pre-existing, dispose of properly)
OPR--9	Mandatory Green education of homeowner by contractor.
OPR--10	Perform radon test in lowest possible habitable space. Mitigate if necessary.
OPR--11	Minimum of one approved and fully operational carbon monoxide alarm installed within ten (10) feet of each bedroom.
OPR--12	No NEW atmospherically vented combustion appliances allowed. (use direct vented, power vented or sealed combustion). Existing atmospherically vented appliances can remain.
OPR--13	All projects must pass Fresh Air Supply (FAS) and Worst Case Combustion Spillage (WCCS) tests at end of the project. See manual for exceptions.
2PR--1	Site plan that locates natural resources
2PR--2	Water conservation plan
2PR--3	Landscape plan promotes water absorption and minimizes soil disturbance
2PR--4	No invasive species, as determined by the MN Extension Agencies, are planted
2PR--5	No cypress mulch
2PR--6	No railroad ties or other landscape materials may be used which contain creosote or chromated copper arsenate
2PR--7	Following construction completion, no part of the disturbed site is left uncovered or destabilized
3PR--2	If choosing to finish a basement, perform thorough risk assessment of existing conditions and systems prior to doing basement finishing work.
3PR--3	Use Integrated Pest Management (IPM) methods to prevent pest entry.
3PR--4	Structural plywood conforming to PS1 and PS2 and oriented strand board (OSB) shall be made with exterior-type adhesives.
3PR--5	New attached garage only allowed if house has pre-existing attached garage. All new attached garages must be built with Breezeway / Mudroom and other measures to minimize the potential for garage pollution to enter the house.
3PR--6	No use of 9-1/4" or greater dimension solid lumber in interior floor, wall or roof systems. (Use 2x8s or smaller in exterior decks as much as possible).
3PR--7	If recessed light fixtures are being added or replaced where they penetrate into the unconditioned area of the attic, then they must be installed to prevent air and thermal leakage.
3PR--8	Any new installation of salvaged doors or windows in an exterior application must be weather stripped, or air sealed with appropriate gasket.
3PR--9	All new connecting doors between living space and attached garage must be gasketed or made substantially air-tight with weather stripping and an automatic closer

3PR--10	No power roof vents unless adequate air inlets exist. See also 5PR -- 7.
3PR--11	Obtain a copy of "FTC Fact Sheet" from the MN Energy Information Center for any type of insulation used on the project. This lists correct R-value for the insulation. (Metro 651-926-5120 or State wide 1-800-657-3710.
3PR--12	All insulation used must be formaldehyde free
3B--PR1	Install radon mitigation system if finishing an unfinished basement.
3B--PR2	Remember basement risk assessment and Calcium Chloride Test before finishing basement.
3C--PR1	When covering a common wall between an attached garage and the home all top and bottom plates must be air sealed
3D--PR1	Replacement sash and units must meet energy code (existing window sashes are exempt)
3D--PR2	Remove weight and fill weight cavity with foam insulation, when old double hung sash are replaced. (no fiberglass insulation allowed for this application)
3D--PR3	Windows are ENERGY STAR and National Fenestration Rating Council (NFRC) labeled (existing window sash are exempt)
4--PR2	If choosing to finish a basement, perform thorough risk assessment of existing conditions and systems prior to doing basement finish work.
4--PR3	Use Integrated Pest Management (IPM) methods to minimize pest entry.
4--PR4	Structural plywood conforming to PS1 and PS2 and oriented strand board (OSB) shall be made with exterior-type adhesives.
4--PR5	All new attached garages must be built with Breezeway / Mudroom and other measures to minimize the potential for garage pollution to enter the house.
4--PR6	No use of 9-1/4" or greater dimension solid lumber in interior floor, wall or roof systems. (Use 2x8s or smaller in exterior decks as much as possible).
4--PR7	If recessed light fixtures are being added or replaced where they penetrate into the unconditioned area of the attic, then new fixtures must be installed to prevent air and thermal leakage.
4--PR8	Any new installation of salvaged doors or windows in an exterior application must be weather stripped, or air sealed with appropriate gasket.
4--PR9	All new connecting doors between living space and attached garage must be gasketed or made substantially air-tight with weather stripping and an automatic closer
4--PR10	No power roof vents unless adequate air inlets exist. See also 5PR -- 7.
4--PR11	Obtain a copy of "FTC Fact Sheet" from the MN Energy Information Center for any type of insulation used on the project. This lists correct R-value for the insulation. (Metro 651-926-5120 or State wide 1-800-657-3710.
4B--PR1	Install soil gas (a.k.a. radon) mitigation system in new basement space (crawlspaces exempt)
4B--PR2	Remember basement risk assessment and Calcium Chloride Test before finishing basement.
4B--PR3	Crawl spaces shall be conditioned (raised pier foundation with no foundation walls are exempt)
4B--PR4	Properly install class 1 or 2 vapor retarder on top of basement and/or crawl space soil or gravel.
4D--PR1	New and Replacement units must meet energy code (existing windows are exempt)
4D--PR2	Windows must be ENERGY STAR and National Fenestration Rating Council (NFRC) labeled (existing window sash are exempt)
4D--PR3	Flash windows and exterior doors with pan, side & head flashing

4D--PR4	Wall cavities exposed during removal of existing full units must be insulated with foam (no fiberglass allowed for this application)
4D--PR5	Air seal around outside of window and door units with low expansion foam insulation.
4D--PR6	New connecting doors between living space and garage are self closing and $\leq 0.30\text{cfm/sq.ft.}$ air leakage rating.
4E--PR1	No recessed light fixtures in finished attic space, or recessed light fixture housing from a conditioned space protruding into an unconditioned attic space, unless installations can be met based on diagram
4E--PR2	Provide attic insulation thickness markers
4E--PR3	Provide attic information card
4E--PR4	If batt insulation is used to insulate knee walls, an attic-side air barrier is required.
4E--PR5	Step flashing & kick-out flashing required at all roof / sidewall locations
5PR--1	No mercury in thermostats, switches or equipment, except fluorescent lights are allowed. If pre-existing, remove and dispose of properly. Replace with programmable thermostat.
5PR--2	No unvented combustion units, with the exception of kitchen-type cooking devices with exhaust ventilation
5PR--3	No equipment is permitted that intentionally produces ozone as a product rather than as an incidental by-product
5PR--4	All clothes dryers must vent to the outside. Any new venting being added must be smooth, rigid duct, and must terminate at least 10 feet from any air intakes and any air conditioning compressor.
5PR--5	No air handlers or conditioning equipment shall be placed in unconditioned spaces (e.g., garage)(does not include condensers)
5PR--6	Ducts must be protected until construction (including floor finishing) is completed (protect returns, intakes & air handling equipment)
5PR--7	No power roof vents unless adequate air inlets exist.
5PR--8	All new ductwork must be sealed
5PR--9	New ducting MAY NOT use building cavities as part of air supply or return system.
5PR--10	All bath fan ducting that is in unheated space shall be insulated to min R8
5PR--11	All new cooling and heating equipment must be installed with a programmable thermostat --AND-- it must be programmed
5PR--12	No new air handling equipment shall be installed in a garage. If existing, it must be in a room sealed off from automobile emissions, and with fresh air supply as required by mechanical equipment within.
5PR--13	Remember to address Worse Case Combustion Spillage (WCCS) and Fresh Air Supply (FAS) when designing and installing any HVAC related equipment.
5C--PR1	All flex duct pulled tight-no pinches
5C--PR2	All new ductwork in unconditioned space insulated (attics = R-30 min.)(walls = R10 min.)
5C--PR3	No building cavities can be used as ductwork (i.e. no panning of joist or wall cavities for duct supply or return)
5D--PR1	No direct expansion systems allowed
5D--PR2	Condensation drains into drain system not under slab
5E--PR1	New Site-built wood burning fireplaces must have gasketed doors, outside combustion air supply, and a means of sealing the flue to minimize interior air (heat) loss when not in operation.

5E--PR2	New Factory-built wood burning fireplaces must meet certification requirements of UL 127 and be EPA Certified (or meet requirements for sale under IPA's voluntary Clean-Burning Fireplace Program).
5E--PR3	New Wood stove and fireplace inserts must be EPA certified and meet certification requirements of US 1482, Section 3.8.
5E--PR4	New Pellet (biomass/agrifuel) stoves and furnaces must meet the requirements of ASTM E1509 or are EPA Certified.
5E--PR5	New Masonry heaters must meet the definition of ASTM e1602 and the IBC 2112.1
6PR--1	New appliances must meet or exceed ENERGY STAR requirements
6PR--2	If recessed light fixtures are being added where they penetrate into the unconditioned area of the attic, then fixtures must be installed to prevent air and thermal leakage. (See 3PR-7 4PR-7)
6PR--3	Adhere to the National Electric Code (NEC) during installation of wiring.
7PR--1	Water Plumbing Fixtures : Code-compliant
7PR--2	Meet National Energy Policy Act (NEPA) standards for "Low-Flow"
7PR--3	No new supplies or drains in exterior walls
8PR--1	All imported hardwood and softwood, except from Canada, must be FSC certified
8PR--2	No Iuan
8PR--3	During the period between finishing and occupancy, ventilate the building with outside air at the highest rate the ventilation system can produce (minimum of 48 hours)
8PR--4	Suspended/Acoustical ceilings are made with recycled materials (at least 60% - recycled content may include slag wool, other mineral wools, cellulose and recycled ceiling tiles - non fiberglass)
8PR--5	No paper-coated drywall in shower or tub surround or other moisture-rich area
8PR--6	No vinyl wall coverings allowed in moisture-rich areas such as bathrooms, kitchens, laundry rooms
8PR--7	All new carpet must be CRI Green Label Plus or third-party certified as low-emitting.
9PR--1	Waste management plan. (See also 0PR-5)
9PR--2	Prepare and post a job-site materials management and recycling plan By posting a job-site materials management and recycling plan the details of the plan are communicated, shared and reinforced with everyone on-site
9PR--3	No burying or burning of construction waste
9PR--4	Seal all ducts and air handlers to prevent contamination during construction.
9PR--5	No construction debris shall be discarded and closed inside any wall assembly
10PR--1	Mandatory green remodeling education of homeowner at end of project (2 hour minimum)
10PR--2	Provide homeowner with a user's manual covering house maintenance and green features of home.

Appendix C: NGBS Site and Community Credits

NGBS Site and Community Credits			
Lot Selection			
501.1			Select lot that minimizes environmental impact
	1		Select infill lot
	2		Select greyfield lot or EPA-recognized Brownfield lot
	3		Implement a renovation or addition (reuse existing building)
501.2			Choose range of mass transit
	1		Select lot within 1/2 mile of pedestrian mass transit access or within 5 miles of mass transit with parking
	2		Provide pedestrian friendly walkways, including connecting to existing sidewalks and developments
	3		Select lot within 1/2 mile of 6 community resources
Project Team, Mission Statement, and Goals			
502.1			A mission statement is developed by an established team with defined member roles
Lot Design			
503.1			Conserve natural resources by
	1		Complete natural resources inventory by a qualified pro
	2		Implement plan to conserve high priority resources identified in inventory
	3		Protect items listed in inventory under direction of a qualified professional
	4		Provide basic training in tree / natural resource protection for onsite supervisor
	5		Pruning on site is conducted by Certified Arborist
	6		Conduct ongoing vegetation maintenance during construction in accordance with TCIA A300
503.2			Slope disturbance is minimized by one or more of the following
	1		Avoid development on steep slopes
		a	Less than 25%
		b	25-75%
		c	Greater than 75%
	2		Complete and use hydrological/soil stability study for steep slopes to guide building design
	3		Align roads, parking, with natural topography
		a	Less than 25%
		b	25-75%
		c	Greater than 75%
	4		Reduce long-term erosion through terracing, retaining walls, landscaping, and restabilizing
	5		Use natural slope for underground parking
	Points shall be awarded only if there are developable steep slopes on the lot		
503.3			Minimize soil disturbance and erosion
	1		Minimize the length of time that soils are exposed during construction

	2		Install utilities in alternate methods from open-cut trenching, such as directional boring; utilize common utility trenches to minimize site disturbance. Use low ground pressure equipment or temporary matting to minimize excessive soil consolidation, or place utilities under paved surfaces instead of yards
	3		Mark in the plan the limits of clearing and grading
503.4			Low Impact Stormwater Management
	1		Preserve and use natural water and drainage features
	2		Develop a stormwater management plan that minimizes concentrated flows/simulates natural flows - vegetative swales, French drains, wetlands, drywells, rain gardens, etc.
	3		Specify permeable materials for roads, driveways, parking areas, walkways, and patios
		a	Less than 25%
		b	25-75%
		c	greater than 75%
	4		Implement a roof that is 75% vegetated
503.5			Create a landscaping plan to limit water and energy use, preserve natural landscape
	1		Create a plan that restores natural vegetation that is cleared for construction; phase landscaping quickly to limit soil exposure
	2		Specify turf grass, vegetation, and trees that are native/regionally appropriate
	3		Turf area is limited
		a	0%
		b	Less than 25%
		c	25-50%
		d	50-75%
	4		Group plants with similar watering needs
	5		Locate trees to increase summer shading of streets, parking areas, dwellings
	6		Design vegetative wind breaks/channels for local conditions
	7		Use onsite tree trimmings/stump grinding of regionally appropriate trees to provide protective mulch during construction, for walking trails, or recycled as saw lumber or pulp wood
	8		Develop integrated pest management plan to minimize chemical use in pesticides and fertilizers
503.6			Plan measures to support wildlife habitat
503.7			Incorporate mixed use development
503.8			Environmentally Sensitive Areas
	1		Avoid Environmentally Sensitive Areas
	2		Restore or mitigate Compromised Environmentally Sensitive Areas
503.9			Density of development is at least
	1		7 to 13 dwelling units per acre
	2		14 to 20 dwelling units per acre
	3		21 or more dwelling units per acre
Lot Construction			
504.1			Supervise and coordinate onsite during clearing, grading, trenching, paving, and utility installation to ensure specified green development practices
504.2			Designate preserved trees and vegetation

	1		Install fencing to protect trees/vegetation
	2		Avoid trenching, significant grading, soil compaction in critical root zones and "tree save" areas
	3		Mitigate damage to existing trees through pruning, root pruning, fertilizing, and watering
504.3			Minimize onsite soil disturbance and erosion by
	1		Stake out limits of clearing and grading prior to construction
	2		Fence or flag "no disturbance" zones
	3		Install and maintain sediment and erosion controls in accordance with storm water pollution prevention plan where needed
	4		Cover topsoil with tarps, straw, mulch, chipped wood, vegetative cover for later use to establish landscape plantings
	5		Distribute weight evenly to prevent soil compaction through plywood, OSB, lightweight geogrids, mulch, chipped wood, etc.
	6		Stabilize disturbed areas (that are complete or to be left unworked for greater than 21 days) within the EPA recommended 14-day period or according to SWPPP
	7		Improve the soil with organic amendments and mulch
	8		Install utilities using alternative means, such as tunneling instead of trenching, smaller equipment use, low ground pressure equipment, geomats, shared utility trenches, or easements
Innovative Practices			
505.1			Share driveways or parking, and do not exceed local minimum parking requirements in multi-unit projects
505.2			Heat Island Mitigation, do any combination of the following for 50% of horizontal hardscape surfaces
	1		Provide shade from existing or new vegetation (within 5 years) or trellises, when measured at the summer solstice at noon
	2		install light-colored hardscape on horizontal surfaces, with a solar reflectance index of 29 or greater

Appendix D: MN GreenStar New Home Non-mandatory Credits Related to Site & Community Impacts

Minnesota GreenStar New Home Non-mandatory Credits Related to Site & Community Impacts	
1	PRECONSTRUCTION DESIGN STRATEGIES
1A --	Integrated Project Team
1A--1	Create multi-disciplinary project team, including homeowner, contractor and all subcontractors and include each in design and pre-construction meetings.
1A--2	Post-construction meeting for contractor, homeowner, and key subcontractors to review performance and lessons learned.
1A--3	Attendance at 8-hour MN GreenStar training by designer/architect from project team
1B--	Design
1B--PR1	Home Energy Rating System (HERS) index of ≤ 75
1B--3	Universal Design
1B--10	Home shares a common driveway with at least one other home
2	Location
2A--	Development Certification
2A--1	Build in an MN GreenStar or LEED-ND Development (not yet available - coming soon)
2B--	Site Selection
2B--1	Build on edge development site
2B--2	Build on infill site
2B--3	Build on greyfield site (previously developed)
2B--4	Build on brownfield site (previously contaminated)
2B--5	Avoid ecologically sensitive sites (threatened species habitat, 100-year flood plain, 100 ft from wetland)
2B--6	Build in fire-safe area, away from highly flammable trees and other vegetation (Rural only)
2B--7	Housing density average >7 units per acre for single family homes
2C--	Infrastructure
2C--1	Build within 1/2 mile of existing water & sewer
2D--	Community, Transportation & Open Space
2D--1a	3 services within 1/2 mile
2D--1b	3 services within 1 mile
2D--1c	6 services within 1/2 mile
2D--1d	6 services within 1 mile
2D--2	Public transportation available within 1/4 mile of site
2D--3	Bike route available within 1/2 mile of site (must connect to community services)
2D--4	Publicly accessible open space (1 acre or greater) within 1/2 mile of site
3	Site and Landscape
3A--	Soil and Permeability
3A --1	Soil tested and amended to achieve optimal nutrient level and structure
3A --2	No impervious surfaces constructed outside building footprint
3A --3a	65% of undeveloped site is permeable
3A --3b	85% of undeveloped site is permeable

3A --3c	100% of undeveloped site is permeable
3A--4	Keep excavated soils on site.
3B --	Planting/Trees
3B --1	50% or more of the lot contains plants or trees other than turf
3B --2	Natural features on site (trees, prairie and wet lands, tundra and ecosystems) are protected during construction.
3B --3	No Heritage trees removed
3B --4	Plantings are compatible with soil type
3B --5	Live trees from site are replanted or donated
3B --6	Restore damaged ecosystem such as existing prairie or wet lands/ Establish wildlife habitat*
3B --8	Install a compost bin
3B --13	Existing and new deciduous trees must shade 50% of sidewalks, patio or drive within 5 years
3B --17	Apply two inches of compost in the top 6 to 12 inches of soil
3B --18	Use slow-release organic fertilizers to establish vegetation
3B --19	Community garden area
3C --	Irrigation
3C --2	Landscape system that requires no municipally-supplied or well water for irrigation (food gardens exempt) (certified by registered professional)
3D --	Decks, Patios and Porches
3D --1	Use permeable paving for patios
3E --	Erosion Control
3E --1	Turf is not installed on slopes exceeding 25% rise
3E --3	Use site material as mulch for erosion control on steep slopes. Ground up construction waste also qualifies. (See Section 9A for additional grinding credits.)
3E --5	Native landscaping is planted along 80% of shoreline
3E --6a	At least one tree/4-5 shrubs is planted per 500 SF of the building footprint, plus the disturbed area
3E --6b	Above plantings are native species
3E --7	Long-term erosion is reduced through terracing, retaining walls, landscaping, or other restabilization techniques
3F --	Rainwater Harvest
3F --1a	20%
3F --1b	50%
3F --1c	90%
3F --2a	20%
3F --2b	50%
3F --2c	90%
3F --2a	40%
3F --2b	80%
3F --5	Install French drains to manage rainwater and to keep storm water onsite
3G --	Grading/Drainage
3G --1	Minimum of 50% (75% over 1 acre) of lot is protected from all grading and tree clearing
3G-- 2	Retill top twelve inches of soil after construction
3G--3	Bearing capacity and soil permeability of the site are tested

3G--4	Re-use all site topsoil, if site disturbance occurs
3G--8	Drainage system at base of garage and driveway that captures run-off and keeps it on-site
4	High Performance Floor, Wall, Ceiling & Roof Assemblies
4A --	PERFORMANCE TESTING
4B --2	Recycled concrete, asphalt or glass for base or fill
4B --6a	25% to 39%
4B --6b	40% or more
4C --	New Exterior Walls Above Grade, All New Non-Slab (framed) Floors, All New Interior Partition Walls & All New Ceilings
4C --1a	Beams & Headers in walls & floors reclaimed (50% to 69%)
4C --1b	Beams & Headers in walls & floors reclaimed (70% to 89%)
4C --1c	Beams & Headers reclaimed (90% or more)
4C --1d	Floor Joists reclaimed (50% to 69%)
4C --1e	Floor Joists reclaimed (70% to 89%)
4C --1f	Floor Joists reclaimed (90% or more)
4C --1g	Subfloor reclaimed (50% to 69%)
4C --1h	Subfloor reclaimed (70% to 89%)
4C --1i	Subfloor reclaimed (90% or more)
4C --1j	Wall Framing reclaimed (30% to 49%)
4C --1k	Wall Framing reclaimed (50% to 69%)
4C --1L	Wall Framing reclaimed (70% to 89%)
4C --1m	Wall Framing reclaimed (90% or more)
4C --3b	Exterior wall sheathing with no added urea-formaldehyde
4C --4a	Plywood, OSB or other sheathing in floors & walls is FSC certified (calculate by square feet) (50% to 89%)
4C --4b	Plywood, OSB or other sheathing in floors & walls is FSC certified (calculate by square feet) (90% or more)
4C --4c	Framing Lumber in floors & walls is FSC certified (calculate by board feet) (50% to 89%)
4C --4d	Framing Lumber in floors & walls is FSC certified (calculate by board feet) (90% or more)
4C --5b	Plywood, OSB or other sheathing in floors & walls is local. (calculate by square feet) (90% or more)
4C --5d	Framing Lumber in floors & walls is local. (calculate by board feet) (90% or more)
4D --	New Windows, Skylights & Doors
4D --7f	Door(s) have metal outer skin. (i.e. aluminum or steel)
4D --7g	Door(s) have fiberglass outer skin.
4E --	New Attics & Roofs
4E --3a	Roof Sheathing with no added urea-formaldehyde (min 90% calculated by square footage)
4E --4a	Roof sheathing is FSC certified (50% to 89%)
4E --4b	Roof sheathing is FSC certified (90% or more)
4E --4c	Roof Framing Lumber is FSC certified (50% to 89%)
4E --4d	Roof Framing Lumber is FSC certified (90% or more)

4E --5b	Plywood, OSB or other sheathing is local. (90% or more)
4E --5d	Framing Lumber is local. (90% or more)
4E --10e	Minimum 40 year roofing material. (min 90% of roof area)
4E --10f	Minimum 50 year roofing material. (min 90% of roof area)
5	MECHANICALS
5D --	Heating and Cooling Equipment
5D --7	Air conditioner refrigerant is HCFC alternative
5D --9	House does not have A/C system and designed to provide passive cooling.
5D --11	Establish interruptible service for air conditioner with electric service
6	ELECTRICAL
6A --	Appliances
6A --1a	Refrigerator
6A --2a	Refrigerator
6A --3a	Refrigerator
6A--10	Provide switched outlets to dedicated media centers and home offices
6B --	Fans, Fixtures and Lights
6B--1ai	50%
6B--1aia	90%
6B--3	Install CFL bulbs in 50% of whole house
6B--4	Install CFL bulbs in 90% of whole house
6B--9	Install LED light fixtures in 50% of high use rooms
6B--10	Install LED light fixtures in 90% of high use rooms
6B--11	Limit total indoor lighting to less than 0.5 watts per square foot
6B --21	Reduce light pollution by shielding fixtures and /or directing light downward
7	WATER - PLUMBING, SYSTEMS AND FIXTURES
7A --	Equipment
1b	Install tankless water heater (elec)
7C--	Piping
7C--1	Run new water lines in copper alternative (PEX)
7D--	Water Systems
7D--2	Install whole house sprinkler system
8	FINISH MATERIALS AND COATINGS
8A --	Wall Coverings and Ceiling Materials
8A--1	Install plaster and lathe on walls and/or ceilings
8A--5e	Salvage/reclaimed/recovered
8A--5i	Certified sustainable manufacturing process
8A--5j	Life cycle impact assessment
8A--6g	FSC certified
8A--6i	Certified sustainable manufacturing process
8A--6j	Life cycle impact assessment
8B--	Flooring
8B--2	Install all hard-surface flooring (no carpet)
8B--8a	Locally sourced
8B--8e	Salvage/reclaimed/recovered
8B--8g	FSC certified

8B--8i	Certified sustainable manufacturing process
8B--8j	Life cycle impact assessment
8B--9a	Locally sourced
8B--9k	Certified sustainable manufacturing process
8B--9l	Life cycle impact assessment
8B--10a	50% of total area
8B--10b	90% of total area
8C --	Millwork and Doors
8C--1a	Locally sourced
8C--1e	Salvage/reclaimed/recovered
8C--1g	FSC certified
8C--1h	reduced waste in manufacturing
8C--1i	Certified sustainable manufacturing process
8C--1j	Life cycle impact assessment
8C--2a	Locally sourced
8C--2e	Salvage/reclaimed/recovered
8C--2g	FSC certified
8C--2h	reduced waste in manufacturing
8C--2i	Certified sustainable manufacturing process
8C--2j	Life cycle impact assessment
8C--3a	50% of total millwork
8C--3b	90% of total millwork
8C--4a	Locally sourced
8C--4h	reduced waste in manufacturing
8C--4i	Certified sustainable manufacturing process
8C--4j	Life cycle impact assessment
8C--5a	Locally sourced
8C--5h	reduced waste in manufacturing
8C--5i	Certified sustainable manufacturing process
8C--5j	Life cycle impact assessment
8C--6a	50% of total doors
8C--6b	90% of total doors
8D --	Countertops
8D --1g	FSC certified
8D --1k	Certified sustainable manufacturing process
8D --1l	Life cycle impact assessment
8D --2g	FSC certified
8D --2k	Certified sustainable manufacturing process
8D --2l	Life cycle impact assessment
8D --3a	50% of total area
8D --3b	90% of total area
8D --4	Wood substrate for countertop has no-added urea formaldehyde
8E--	Cabinetry
8E--1h	Certified sustainable manufacturing process
8E--1i	Life cycle impact assessment
8F--	Coatings and Adhesives

8F--1	Supply workers with VOC protection
9	WASTE MANAGEMENT
9A --	Construction Waste
9A --1	Require subcontractors to participate in waste reduction and recycling efforts
9A--2a	Packaging
9A--2b	Workers' beverage containers
9A--2c	Cardboard from new fixtures, appliances, and cabinets (90% minimum)
9A--2d	Metal - copper, brass, lead and aluminum and non precious metals like steel, tin or sheet metal (90% minimum)
9A--2e	Asphalt roofing (70% minimum)
9A--2f	Brick and block (70% minimum)
9A--2g	Drywall - grind or remove, and recycle (70% minimum)
9A--2h	Carpet (70% minimum)
9A--2i	Paints, primers, stains and sealants (see manual for explanation)
9A--2j	Insulation (70% minimum)
9A--2k	Recycle or compost yard waste (minimum 90%)
9A--2l	Wood scrap and broken pallets (70% landfill diversion)
9A--2m	Asphalt or concrete rubble (70% minimum)
9A--3	Grind wood waste and stumps and use as mulch (70% minimum)
9A--6	Reuse supplies for operations, such as construction fences, tarps, refillable propane tanks
9A--7	Wash out concrete trucks in slab or pavement sub-base areas and provide appropriate clean up areas for other trades (e.g. paint or plaster)
9A--9	Framing waste is less than 10% of total framing order
9A--10	Job site framing plan and cut list
9A--11	Donation/sale or give away of excess materials for reuse
9A--12	Deconstruct existing structure and reuse or recycle approximately 90% of the building materials
9B --	Homeowner Waste Reduction
9B --1	Install recycle center for homeowner use
9B --2	Provide kitchen scrap compost bin and exterior compost bin
9B --3	Store and provide weather protection to building materials for future use by homeowner
10	EDUCATION
10A --	Homeowner and Subcontractor Education
10A --1	Expand homeowner's user manual
10A--3	Homeowner given a walk through education during framing to explain design and construction of their home.
11	INNOVATION
11A --	Performance Design and Alternative Methods
11A --1	Trees removed for construction are milled and incorporated in the project
11A2	Use alternative building systems, e.g., Durasol, Fasswall, Autoclaved Aerated Concrete
11A --3	Cold climate appropriate natural building system (e.g. straw bale, cordwood, etc)
11A --7	Submit one year's worth of utility usage data to MN GreenStar after completion of home. (See attached "Utility Tracking Table 11A--7)

Appendix E: NGBS Credits relating to Materials

NGBS Credits relating to Materials		
Quantity of Construction Materials and Waste		
601.1		Limit conditioned floor area. Calculate dwelling unit size by ANSI Z765, only conditioned floor area above grade plane is included
	1	< or = 1,000 sq. ft.
	2	< or = 1,500 sq. ft.
	3	< or = 2,000 sq. ft.
	4	< or = 2,500 sq. ft.
	5	> 4,000 sq. ft. An additional one point shall be require in Table 303.2 to achieve any given rating level for every 100 square feet over 4,000.
601.2		Implement building-code compliant structural systems or advanced framing techniques that optimize materials usage.
601.3		Design building dimensions to reduce material cuts and waste
	1	at least 80% of floor areas
	2	at least 80% of wall areas
	3	at least 80% or roof area
	4	at least 80% of cladding or siding area
	5	at least 80% of penetrations or trim area
601.4		Provide detailed framing/structural plans, material quantity lists & onsite cut lists for framing, structural materials, and sheathing materials
601.5		Utilize pre-cut/pre-assembled components, panelized, or precast assemblies (90%)
	1	Floor system
	2	Wall system
	3	Roof system
	4	Above-grade modular or manufacture construction for entire building
601.6		Stack stories that are above grade; the area of the upper story shall be at least 50% of the area of the story below based on areas with ceiling height of at least 7 feet
		first stacked story
		per additional story
601.7		Utilize materials/assemblies that do not require additional site-applied finishing material
	1	Pigmented, stamped, decorative, or final finish concrete/masonry
	2	Trim not requiring paint or stain
	3	Window, skylight, door assemblies not requiring paint or stain on exterior and/or interior surfaces
	4	Wall coverings or systems not requiring paint or stain or other type of finishing application
		90% of assembly above
		50% of assembly above

601.8		Design and construct frost-protected shallow foundations, pier and pad foundations, post foundations, etc.
601.9		Use an above grade wall system that provides sufficient structural and thermal characteristics (for at least 75% of gross exterior wall area), choose one
	1	Adobe
	2	Concrete/Masonry
	3	Logs
	4	Rammed Earth
602		Enhanced Durability and Reduced Maintenance
602.1		Protect building from precipitation and solar radiation, with a projection factor of at least 0.375.
	1	Install a porch roof or awning
	2	Extending the roof overhang
	3	Recessing the exterior door
		Main entrance door
		Additional covered door assembly
602.2		Protect building envelope with roof overhangs for at least 90% of exterior walls
602.3		Foundation Drainage
	1	Install exterior drain tile where required by the IRC/IBC for habitable and usable spaces below grade
	2	Install interior and exterior foundation perimeter drains, and slope them to discharge daylight, dry well, or sump pit
602.4		Install drip edge at eaves and gable roof edges
602.5		Install gutter and downspout system to carry water at least 5' from perimeter foundation walls, or splash blocks and effective grading
602.6		Provide a minimum of 6 inches of fall of sloped grade within 10 feet of the building edge. Where lot lines, walls, slopes or other physical barriers prohibit 6 inches of fall within 10 feet, the final grade shall slope away from the building edge at a minimum slope of 5% and the water shall be directed to drains or swales.
602.7		Install continuous, physical foundation termite barrier used with or without low toxicity treatment in geographical areas that have subterranean termite infestation potential (see figure 6(3))
602.8		Use termite-resistant materials for structural components/exterior claddings of walls, floors, concealed roof spaces, and exterior decks in geographical areas that might have slight to moderate termite potential
	1	In areas slight to moderate
	2	In areas moderate to heavy
	3	In areas very heavy
602.9		Install a water-resistive barrier and/or drainage plane system behind exterior veneer and/or siding
602.10		Install an ice barrier at roof eaves that is extended at least 24" inside the exterior wall line of the building in accordance with the IRC/IBC in areas where there has been a history of ice forming along the eaves

602.11		Install an enhanced foundation waterproofing
	1	Rubberized coating or
	2	Drainage mat
602.12		Show flashing details on plans, install according to plan in the locations:
	1	Around exterior fenestrations, skylights, and doors
	2	Roof valleys
	3	Deck/balcony to building intersections
	4	At roof-to-wall intersection and at roof-to-chimney intersections
	5	A drip cap is provided above windows and doors that are not flashed or protected by covering per Section 602.1
602.13		Construct at least 90% of roof surfaces to one or both of the following
	1	Products which meet the requirements of the ENERGY STAR cool roof certification or equivalent
	2	A green (landscaped) roof system
602.14		Facilitate occupant recycling by:
	1	A built-in collection space in each kitchen and an aggregation/pick-up space in a garage, covered outdoor space or other area for recycling containers
	2	Compost facility provided on-site
603		Reused or Salvaged Materials
603.1		Reuse, modify, or deconstruction existing buildings and structures in lieu of demolition, for every 200 feet of floor area
603.2		Use reclaimed and/or salvaged materials and components
	1	Total material and labor cost of salvaged materials shall equal or exceed 1% of total construction costs
603.3		Facilitate construction sorting and reuse of scrap building materials by
	1	Providing a central storage area
	2	Providing dedicated bins
604		Recycled-Content Building Materials
604.1		Use building materials with recycled content for two minor and/or two major components of the building
605		Recycled Construction Waste
605.1		Develop a construction waste management plan, implement it, and post it at the jobsite to recycle or salvage at least 50% by weight of construction and land clearing waste
605.2		implement onsite recycling measures following applicable regulations and codes, such as the following
	1	Materials are ground or otherwise safely applied onsite as soil amendment or fill. At least 50% (by weight) of construction and land clearing waste shall be diverted from landfill
	2	Other methods approved by the Adopting Entity
605.3		Recycle offsite construction materials such as wood, cardboard, metals, drywall, plastic, asphalt roofing shingles, or concrete
	1	A minimum of two types of materials are recycled
	2	Per additional recycled material

606		Renewable Materials
606.1		Use the following biobased products: Certified solid wood in accordance with Section 606.2, engineered wood, bamboo, cotton, cork, straw, natural fibers, products made from crops (soy-based, corn-based), other biobased materials with at least 50% biobased content (by weight or volume) or products with the minimum biobased contents of the USDA's Designation of BioPreferred.
		Two types of biobased materials, each more than 0.5% of projects projected material cost
		Two types of biobased materials, each more than 1% of projects projected material cost
		Per additional biobased material used for more than 0.5% of the project's project building material cost
606.2		Use wood or wood-based products that are certified to one of the following recognized programs, where a minimum of two certified wood-based products are used for minor elements of the building, such as all trim, cabinetry, or millwork.
		Where a minimum of two certified wood-based products are used in major elements of the building, such as walls, floors, or roof
	1	American Tree Farm System
	2	CSA
	3	FSC
	4	PEFC
	5	SFI
	6	Other programs recognized by the PEFC
606.3		Use materials for major components of the building which are manufactured with at least 33% primary energy derived for manufacturing from renewable sources, combustible waste sources, or renewable energy credits (RECs).
607		Resource-Efficient Materials
607.1		Use products that contain fewer materials to meet the same end-use requirements as conventional products, including
	1	Lighter, thinner brick with bed depth less than 3 inches, brick wire coring above 25% or both
	2	Engineered wood or engineered steel products
	3	Roof or floor trusses
608		Indigenous Materials
608.1		Use indigenous materials for major elements of the building
	1	1 type of material
	2	Per additional material
609		Life Cycle Analysis
609.1		Select the more environmentally preferable products based on a LCA tool, that is compliant with ISO 14044
		OR Whole building LCA analysis
610		Innovative Practices

610.1		Choose products whose manufacturing operations and business practices include environmental management system concepts and the production facility is ISO 14001 certified or equivalent. The aggregate value of the building products is at least 1% of the estimated total materials cost.
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Appendix F: MN GreenStar New Home Non-mandatory Credits Related to Materials and Durability

Minnesota GreenStar New Home	
Non-mandatory Credits Related to Materials and Durability	
1A --	Integrated Project Team
1A--1	Create multi-disciplinary project team, including homeowner, contractor and all subcontractors and include each in design and pre-construction meetings.
1A--2	Post-construction meeting for contractor, homeowner, and key subcontractors to review performance and lessons learned.
1A--3	Attendance at 8-hour MN GreenStar training by designer/architect from project team
1B--	Design
1B--3	Universal Design
1B--4	Allocate space in the home as a disaster protection area
1B--9	Home utilizes incremental design techniques with documented provisions to expand to meet future growing needs
2	Location
2B--	Site Selection
2B--6	Build in fire-safe area, away from highly flammable trees and other vegetation (Rural only)
3	Site and Landscape
3B --	Planting/Trees
3B --7	Participate in a wildlife conservation program
3B --8	Install a compost bin
3B --10	Edible landscape planting/food garden is installed
3B --15a	24"
3B --15b	36"
3D --	Decks, Patios and Porches
3D --2	Wood use is kept at least 12 inches from soil
3D --3	Use re-claimed material for deck or porch (80%)
3D --4	Decking or patio material is made from recycled content and has low-toxicity
3D--5	Wood to concrete connections prevent moisture wicking. (e.g. end grains have min. 3/8" air space. --AND-- side grains separated by 3/8" air space and/or flashing.)
3D--6	Deck ledger boards attached to home with either minimum 3/8" spacers and full flashing shingle fashion from drainage plane to over framing or adhesive membrane strip taped to drainage plane running over ledger board and folded around joists
3E --	Erosion Control
3E --4	Recycled materials used for silt fencing
3F --	Rainwater Harvest
3F --2a	20%
3F --2b	50%
3F --2c	90%
3F --3	Vegetated or green roof is pitched

3G --	Grading/Drainage
3G--3	Bearing capacity and soil permeability of the site are tested
3G--5	Patio slabs, walks and driveway shall be sloped a minimum of 1/8" per foot away from house
3G--6	Land is re-graded (or terraced) to slope away from house (min. 5% slope 10 feet away from foundation walls) (minimum 6" within first 10 feet)
3G--7	Slope garage floor toward main vehicle entry doorway, or integrated floor drains, minimum 1/8" per foot
4	High Floor, Wall, Ceiling & Roof Assemblies Performance
4B --	New Foundations, Crawlspace & Slab Floor Assemblies
4B --1	Install 4" bed of 3/4" diameter or greater clean or washed gravel on top of basement and/or crawlspace soil before any other flooring work is done.
4B --2	Recycled concrete, asphalt or glass for base or fill
4B --5	Take measures to minimize and control cracking in interior concrete slabs. Install reinforcing AND provide control joints at proper locations.
4B --6a	25% to 39%
4B --6b	40% or more
4B --8	Reusable footing and foundation forms are used
4B --9	Install 4" min. perforated foundation drain w/ 3/4" gravel and filter fabric at <u>outside</u> perimeter of new footings. (top of tile below bottom of interior slab floor)
4B --10	Install 4" min. perforated foundation drain w/ 3/4" gravel and filter fabric at <u>inside</u> perimeter of new footings.
4B --11	Install frost protected shallow foundation. (cannot be used in connection with other types of foundations. See Also IRC Code R403.3)
4B --12	Provide capillary breaks. 1. between top of footings and bottom of foundation wall. 2. below slabs. 3. where cementitious products connect to framing material (i.e. garage floors, stoops, and porches)
4B --14	Foundation built with insulated concrete forms (ICF) or Insulated concrete "T" Mass or equivalent system with a minimum of R14
4B --15	Insulated pre-cast concrete foundation system is used w/ min. R-10 Insulation.
4B --16	Foundation walls are solid concrete -- OR -- CMU wall with top course of filled cores, solid block or bond beam.
4B --17a	30%
4B --17b	50%
4B --17c	90%
4B --18	Water based waterproofing system
4B --19	Install material which protects waterproof membrane and functions as a hydrostatic pressure release. (I.e. dimpled polyethylene, porous fiberglass board)

4B --20	Foundation walls not covered with masonry veneer cladding are capped with sun interrupted termite sheet metal, plastic or equivalent termite shield that extends a minimum of 1/2 inch beyond the interior and exterior sides of the wall, before installation of the sill plate
4B --21	Install vapor impermeable, dimpled sheet continuous from under slab to top of interior foundation wall. Seal all edges.
4B --23	Use spray foam to air seal and insulate interior foundation walls and rim joists. Note: If foundation cannot dry to exterior above grade through minimum of 16" of exposed foundation and/or rim joist area is not separated from foundation by a capillary break, then closed cell foam insulation CANNOT exceed the thickness that would reduce its vapor permeability to 1 perm or less.
4B --24	Use steel studs to fur out new foundation walls for basement finishing.
4C --	New Exterior Walls Above Grade, All New Non-Slab (framed) Floors, All New Interior Partition Walls & All New Ceilings
4C --1a	Beams & Headers in walls & floors reclaimed (50% to 69%)
4C --1b	Beams & Headers in walls & floors reclaimed (70% to 89%)
4C --1c	Beams & Headers reclaimed (90% or more)
4C --1d	Floor Joists reclaimed (50% to 69%)
4C --1e	Floor Joists reclaimed (70% to 89%)
4C --1f	Floor Joists reclaimed (90% or more)
4C --1g	Subfloor reclaimed (50% to 69%)
4C --1h	Subfloor reclaimed (70% to 89%)
4C --1i	Subfloor reclaimed (90% or more)
4C --1j	Wall Framing reclaimed (30% to 49%)
4C --1k	Wall Framing reclaimed (50% to 69%)
4C --1L	Wall Framing reclaimed (70% to 89%)
4C --1m	Wall Framing reclaimed (90% or more)
4C --2a	Beams & Headers in walls & floors (eng./steel/truss) (60% to 89%)
4C --2b	Beams & Headers in walls & floors (eng./steel/truss) (90% or more)
4C --2c	Floor Joists (eng./steel/truss) (60% to 89%)
4C --2d	Floor Joists (eng./steel/truss) (90% or more)
4C --2e	Wall Framing (eng./steel/truss) (30% to 49%)
4C --2f	Wall Framing (eng./steel/truss) (50% to 89%)
4C --2g	Wall Framing (eng./steel/truss) (90% or more)
4C --4a	Plywood, OSB or other sheathing in floors & walls is FSC certified (calculate by square feet) (50% to 89%)
4C --4b	Plywood, OSB or other sheathing in floors & walls is FSC certified (calculate by square feet) (90% or more)
4C --4c	Framing Lumber in floors & walls is FSC certified (calculate by board feet) (50% to 89%)
4C --4d	Framing Lumber in floors & walls is FSC certified (calculate by board feet) (90% or more)
4C --5a	Plywood, OSB or other sheathing in floors & walls is local. (calculate by square feet) (50% to 89%)
4C --5b	Plywood, OSB or other sheathing in floors & walls is local. (calculate by square feet) (90% or more)

4C --5c	Framing Lumber in floors & walls is local. (50% to 89%)	(calculate by board feet)
4C --5d	Framing Lumber in floors & walls is local. (90% or more)	(calculate by board feet)
4C --6a	Wood framed panels (min. 80% of interior walls)	
4C --6b	Wood framed panels (min. 80% of exterior walls)	
4C --6c	Structural Insulated Panels (SIP) (min. 80% exterior walls)	
4C --6d	Structural Insulated Panels (SIP) (min. 80% roofs)	
4C --7	Insulated Concrete Forms (ICF) or Insulated Concrete "T" Mass walls are used for exterior above grade. (min.90%)	
4C --8a	19.2" or 24" o.c. framing	
4C --8b	2 stud corners with drywall clips	
4C --8c	Single top plate	
4C --8d	Door & Window headers sized for load	
4C --8e	Jack studs eliminated. (header hanger used)	
4C --9a	Insulation with minimum 20% recycled content is used for at least 50% of applications (calculate R-value x Sq.Ft.)	
4C --9b	All-natural insulation, such as cotton batt, is used for at least 50% of applications. (Soy based foam insulation is not considered "all natural" and is not eligible for credit in this category)	
4C --9c	Spray foam insulation applied in new studs	
4C --9d	Spray applied wet cellulose insulation (proper drying required before installing wall finish and/or vapor barrier)	
4C --10b	Seams and penetrations in rim joist between conditioned floors are sealed	
4C --10e	Cantilevered floor sealed above supporting wall	
4C --10g	Seal all gypsum or magnesium board penetrations in exterior walls using caulk, gaskets or appropriate connection with gypsum board	
4C --10h	Seal drywall at top plate, bottom plate and penetrations with gasket, sealant or glue	
4C --11a	Drainage plane and air/drainage space behind siding	
4C --11b	Siding and trim are back-primed on all sides	
4C --11c	Fiber-cement or wood composite siding installed (min. 50% of siding used)	
4C --11d	Steel siding with ENERGY STAR coating and long-life factory finish	
4C --11e	Exposed wood is kept at least 12 inches from soil	
4C --11f	Use reclaimed brick (for exterior wall covering) and block (for foundation)	
4C --11g	Install traditional three-coat stucco	
4D --	New Windows, Skylights & Doors	
4D --1d	Windows are wood	
4D --1e	Windows and/or skylights are fiberglass	
4D --1f	Windows and/or skylights are wood-with metal clad exterior	
4D --1k	Install storm windows on double hung or fixed windows	
4D --1L	Wood used in window construction (if any) is FSC certified	

4D --1m	20 year warranty on windows with wood frame. (Warranty must apply to glazing, sash and frame) (min. 90% of new units)
4D --6a	1 entry
4D --6b	2 or more entries
4D --7e	Door(s) are wood.
4D --7f	Door(s) have metal outer skin. (i.e. aluminum or steel)
4D --7g	Door(s) have fiberglass outer skin.
4D --7h	Wood used in door(s) (if any) is FSC certified (90% of doors containing wood)
4D --7i	Install storm door at all entries. (sliding doors exempt)
4D --7j	20 year warranty on all doors with wood frame. (warranty must apply to glazing, sash and frame.
4E --	New Attics & Roofs
4E --1a	Roof Beams & Headers reclaimed (50% to 69%)
4E --1b	Roof Beams & Headers reclaimed (70% to 89%)
4E --1c	Roof Beams & Headers reclaimed (90% or more)
4E --1d	Rafters or Trusses reclaimed (50% to 69%)
4E --1e	Rafters or Trusses reclaimed (70% to 89%)
4E --1f	Rafters of Trusses reclaimed (90% or more)
4E --1g	Roof Sheathing reclaimed (50% to 69%)
4E --1h	Roof Sheathing reclaimed (70% to 89%)
4E --1i	Roof Sheathing reclaimed (90% or more)
4E --1j	Install recycled content roofing material (min 25% recycled content)
4E --2a	Roof Beams & Headers (50% to 89%)
4E --2b	Roof Beams & Headers (90% or more)
4E --2c	Roof Framing (50% to 89%) (roof trusses qualify)
4E --2d	Roof Framing (90% or more) (roof trusses qualify)
4E --4a	Roof sheathing is FSC certified (50% to 89%)
4E --4b	Roof sheathing is FSC certified (90% or more)
4E --4c	Roof Framing Lumber is FSC certified (50% to 89%)
4E --4d	Roof Framing Lumber is FSC certified (90% or more)
4E --5a	Plywood, OSB or other sheathing is local. (50% to 89%)
4E --5b	Plywood, OSB or other sheathing is local. (90% or more)

4E --5c	Framing Lumber is local. (50% to 89%)
4E --5d	Framing Lumber is local. (90% or more)
4E --6a	Wood framed panels (min. 80% of roofs)
4E --6b	Structural Insulated Panels (SIP) (min. R38) (min. 80% roofs)
4E --7a	19.2" or 24" o.c. roof framing
4E --7b	Rafters align with wall framing below
4E --8a	Insulation with minimum 20% recycled content is used for at least 50% of applications (calculate R-value x Sq.Ft.)
4E --8b	All-natural insulation, such as cotton batt, is used for at least 50% of applications. (Soy based foam insulation is not considered "all natural" and is not eligible for credit in this category)
4E --8f	Add 1" min. foil face polyisocyanurate insulation to sloped roof / ceiling for thermal break and vapor barrier
4E --8g	Add 2" rigid insulation to interior of sloped roof / ceiling for thermal break and vapor barrier
4E --9c	Provide insulation wind baffle or other air barrier to block wind washing at all attic eave bays in roof assemblies with soffit vents
4E --10a	Self sealing bituminous membrane at valleys & penetrations (code required at eaves)
4E --10b	Self sealing bituminous membrane over entire roof deck
4E --10c	Metal drip edge at all roof edges & "W" shaped valley flashing at valleys
4E --10d	Metal "W" shaped valley flashing at valleys
4E --10e	Minimum 40 year roofing material. (min 90% of roof area)
4E --10f	Minimum 50 year roofing material. (min 90% of roof area)
4E --10g	Lifetime roofing material (including: slate, steel, concrete, clay, etc.) (min 90% of roof area)
4E --11a	16" to 23"
4E --11b	24" to 31"
4E --11c	32" or more
4E --12	Install roof gutters to discharge water 5' away from any foundation or, in limited spaces, deposit into underground pipe that carries water min. 10 feet from foundation
4E --13	Design and specify balanced roof ventilation system. (Non-vented "Hot" roofs also qualify if drawings are included to show critical details. i.e. @ roof / wall intersections.)
4E --14	Implement design from 4E -13. Install-new eave vents, vent chutes, roof vents, etc ---OR--- Implement non-vented strategy. (Non-vented designs must be pre-approved by building code official.)
5	MECHANICALS
5A --	Ventilation and Fresh Air for Occupants
5A--1a	range hood \leq 300 cfm

5A --1b	range hood > 300 cfm
5A --1c	ceiling exhaust fan or duct
5A --2a	1 Room
5A --2b	2 Rooms
5A --2c	3 Rooms
5A --2d	4 or more rooms
5A--4a	1 Room
5A--4b	2 Rooms
5A--4c	3 Rooms
5A--4d	4 or more rooms
5A--8	Heat recovery ventilator (HRV) installed
5A--9	Energy recovery ventilator (ERV) installed
5B --	Moisture and Relative Humidity
5B --1	Install temperature and humidity sensors and record indoor/outdoor data for one year after project work. See attached "Temperature and Relative Humidity Tracking Table 5B -- 1"
5B --2	Installation of ENERGY STAR dehumidifier equipped with humidity sensor. (Portable, Stand-alone & HVAC integrated qualify)
5C --	HVAC DISTRIBUTION STRATEGIES
5C --3e	Furnace located to minimize length of duct runs
5C --3f	Ductwork sealed with water-based, low-VOC (<30 g/l) mastic or aerosol sealant
5C --3g	Boiler located to minimize length of supply lines.
5C --4	Properly designed ductless HVAC system installed in home. Ducted bath fan, kitchen hood and make-up air allowed.
5D --	Heating and Cooling Equipment
5D --1	Design and install heating a cooling equipment according to manual J calculations.
5D --5	Install hydronic in-floor heating system connected to heat source that has at least 80% AFUE boiler. Connecting to ground source heat pump or hot water solar systems also qualify.
5D --9	House does not have A/C system and designed to provide passive cooling.
5E --	Miscellaneous Mechanical
5E --1	Do not install a decorative fireplace or stove of any kind
6	ELECTRICAL
6A --	Appliances
6A--11	Install whole house surge protection
6B --	Fans, Fixtures and Lights
6B--6	Install LED bulbs in all recessed can light fixtures
6B--7	Install three LED light fixtures
6B--8	Install six LED light fixtures
6B--11	Limit total indoor lighting to less than 0.5 watts per square foot
6B--16	No recessed light fixtures installed in any part of the house
6B--17	No recessed light fixtures in insulated ceilings
6C --	Wiring
6C--1	Direct wire all bath fans to light switch or humidistat

6C--4	All electrical wiring run in metal conduit
6C--5	Run wiring in bedrooms in metal conduit
6D--	Electrical Systems
6D--4a	All wiring within 6' of a bed is run in metal conduit (flexible and rigid qualify)
6D--4b	All electrical wiring in whole house run in metal conduit (flexible and rigid qualify)
7	WATER - PLUMBING, SYSTEMS AND FIXTURES
7A --	Equipment
7B--	Fixtures
7C--	Piping
7C--1	Run new water lines in copper alternative (PEX)
7D--	Water Systems
7D--2	Install whole house sprinkler system
8	FINISH MATERIALS AND COATINGS
8A --	Wall Coverings and Ceiling Materials
8A--1	Install plaster and lathe on walls and/or ceilings
8A--5b	Contains minimum 25% post-consumer recycled content
8A--5c	Contains minimum 40% post-industrial recycled content
8A--5e	Salvage/reclaimed/recovered
8A--5f	Rapidly renewable content
8A--5g	FSC certified
8A--5h	Refinishable/resurfaceable
8A--5j	Life cycle impact assessment
8A--6b	Contains minimum 25% post-consumer recycled content
8A--6c	Contains minimum 40% post-industrial recycled content
8A--6e	Salvage/reclaimed/recovered
8A--6f	Rapidly renewable content
8A--6g	FSC certified
8A--6h	Refinishable/resurfaceable
8A--6j	Life cycle impact assessment
8A--7a	50% of total area
8A--7b	90% of total area
8B--	Flooring
8B--2	Install all hard-surface flooring (no carpet)
8B--4	Install sealed concrete floor (min. 80% of interior finish slab-work)
8B--7	Tile installed over poured cementitious bed with lathe
8B--8b	Contains minimum 25% post-consumer recycled content
8B--8c	Contains minimum 40% post-industrial recycled content
8B--8e	Salvage/reclaimed/recovered
8B--8f	Rapidly renewable content
8B--8g	FSC certified
8B--8h	Refinishable/resurfaceable
8B--8i	reduced waste in manufacturing
8B--8j	recyclable

8B--8j	Life cycle impact assessment
8B--9b	Contains minimum 25% post-consumer recycled content
8B--9c	Contains minimum 40% post-industrial recycled content
8B--9e	Salvage/reclaimed/recovered
8B--9f	Rapidly renewable content
8B--9g	FSC certified
8B--9h	Refinishable/resurfaceable
8B--9i	reduced waste in manufacturing
8B--9j	recyclable
8B--9l	Life cycle impact assessment
8B--10a	50% of total area
8B--10b	90% of total area
8C --	Millwork and Doors
8C--1b	Contains minimum 25% post-consumer recycled content
8C--1c	Contains minimum 40% post-industrial recycled content
8C--1e	Salvage/reclaimed/recovered
8C--1f	Rapidly renewable content
8C--1g	FSC certified
8C--1h	reduced waste in manufacturing
8C--1i	Certified sustainable manufacturing process
8C--1j	Life cycle impact assessment
8C--2b	Contains minimum 25% post-consumer recycled content
8C--2c	Contains minimum 40% post-industrial recycled content
8C--2e	Salvage/reclaimed/recovered
8C--2f	Rapidly renewable content
8C--2g	FSC certified
8C--2h	reduced waste in manufacturing
8C--2i	Certified sustainable manufacturing process
8C--2j	Life cycle impact assessment
8C--3a	50% of total millwork
8C--3b	90% of total millwork
8C--4b	Contains minimum 25% post-consumer recycled content
8C--4c	Contains minimum 40% post-industrial recycled content
8C--4e	Salvage/reclaimed/recovered
8C--4f	Rapidly renewable content
8C--4g	FSC certified
8C--4h	reduced waste in manufacturing
8C--4i	Certified sustainable manufacturing process
8C--4j	Life cycle impact assessment
8C--5b	Contains minimum 25% post-consumer recycled content
8C--5c	Contains minimum 40% post-industrial recycled content
8C--5e	Salvage/reclaimed/recovered
8C--5f	Rapidly renewable content
8C--5g	FSC certified
8C--5h	reduced waste in manufacturing
8C--5i	Certified sustainable manufacturing process

8C--5j	Life cycle impact assessment
8C--6a	50% of total doors
8C--6b	90% of total doors
8D --	Countertops
8D --1b	Contains minimum 25% post-consumer recycled content
8D --1c	Contains minimum 40% post-industrial recycled content
8D --1e	Salvage/reclaimed/recovered
8D --1f	Rapidly renewable content
8D --1g	FSC certified
8D --1h	Refinishable/resurfaceable
8D --1i	reduced waste in manufacturing
8D --1j	recyclable
8D --1l	Life cycle impact assessment
8D --2b	Contains minimum 25% post-consumer recycled content
8D --2c	Contains minimum 40% post-industrial recycled content
8D --2e	Salvage/reclaimed/recovered
8D --2f	Rapidly renewable content
8D --2g	FSC certified
8D --2h	Refinishable/resurfaceable
8D --2i	reduced waste in manufacturing
8D --2j	recyclable
8D --2l	Life cycle impact assessment
8D --3a	50% of total area
8D --3b	90% of total area
8E--	Cabinetry
8E--1b	Contains minimum 40% post-industrial recycled content
8E--1d	Salvage/reclaimed/recovered
8E--1e	Rapidly renewable content
8E--1f	FSC certified
8E--1g	reduced waste in manufacturing
8E--1i	Life cycle impact assessment
8E--2	90% of cabinetry is in a combination of materials that have 1 or more Green attributes
8E--3	Seal all edges of cabinetry not labeled as "no-added urea formaldehyde" prior to assembly
8F--	Coatings and Adhesives
9	WASTE MANAGEMENT
9A --	Construction Waste
9A --1	Require subcontractors to participate in waste reduction and recycling efforts
9A--2g	Drywall - grind or remove, and recycle (70% minimum)
9A--2l	Wood scrap and broken pallets (70% landfill diversion)
9A--2m	Asphalt or concrete rubble (70% minimum)
9A--3	Grind wood waste and stumps and use as mulch (70% minimum)
9A--5	Obtain products from suppliers that use recyclable or reusable packaging

9A--8	Building materials stored on site are protected from weather exposure. Materials wetted during the construction process are allowed to dry before enclosing in building assembly.
9A--9	Framing waste is less than 10% of total framing order
9A--12	Deconstruct existing structure and reuse or recycle approximately 90% of the building materials
9B --	Homeowner Waste Reduction
10	EDUCATION
10A --	Homeowner and Subcontractor Education
10A --1	Expand homeowner's user manual
10A--3	Homeowner given a walk through education during framing to explain design and construction of their home.
11	INNOVATION
11A --	Performance Design and Alternative Methods
11A --1	Trees removed for construction are milled and incorporated in the project
11A2	Use alternative building systems, e.g., Durasol, Fasswall, Autoclaved Aerated Concrete
11A --3	Cold climate appropriate natural building system (e.g. straw bale, cordwood, etc)
11A --4	Unique partnerships formed to advance resource-efficient building
11A --5	Air and moisture barrier at exterior
11A --7	Submit one year's worth of utility usage data to MN GreenStar after completion of home. (See attached "Utility Tracking Table 11A--7)
11B --	Design for Reduced Electrical and Magnetic Fields
11B --1a	Install polyethylene pipe for water service supply pipe underground
11B --9	Install CAT-5e or CAT-6 shielded data cable throughout house to every room where computers will be used

Appendix G: NGBS Credits Related to Energy Efficiency

NGBS Credits related to Energy Efficiency		
701		Minimum Energy Efficiency Requirements
701.1		
701.1.1		Minimum Performance Path Requirements - A building complying with Section 702 shall exceed the baseline minimum performance required by the IECC by 15%, and shall include a minimum of two practices from Section 704.
701.1.2		
701.1.3		Alternative Bronze Level Compliance. As an alternative, any building meeting ENERGY STAR qualified home requirements or equivalent achieves compliance with the Bronze Level for the Energy Chapter.
701.2		Emerald Level Points. The Performance Path shall be used to achieve the Emerald Level
701.3		A review by the Adopting entity or designated third party shall be conducted to verify design and compliance with this Chapter.
701.4		Mandatory Practices
701.4.1		Size space heating and cooling system/equipment according to heating and cooling loads calculated using ACCA (Manual J) or equivalent
701.4.2		Design radiant or hydronic space heating systems using industry-approved guidelines such as the following if it's a primary heat source
	1	ACCA (Manual J)
	2	GAMA H-22
	3	Accredited design professionals and manufacturer's recommendations
701.4.3		Seal ducts with UL 181 tape, mastic, gaskets, or an approved system as required by the IRC (Section M1601.3.1) or IMC (Section 603.9) to reduce leakage
701.4.4		Do not use building cavities as supply ducts
701.4.5		Insulation and Air Sealing
701.4.5.1		Insulation and Air Sealing shall be installed in accordance with the manufacturer's instructions or local code, as applicable
		Fully seal openings to unconditioned space with solid blocking or flashing, and any remaining gaps with caulk or foam. Install fire-rated collars and caulking where required. (Shafts - Ducts, Piping Shaft/Penetrations, Flue Shaft)
701.4.5.2		FLOORS: Install insulation to maintain permanent contact with the underside of the subfloor decking, enveloping any attached ductwork within the thermal envelope without compression or air gaps in the insulation, except where ducts or other mechanical equipment are adjacent to the underside of the subfloor. Batt and loose-fill insulation is held in place by permanent attachments or systems per manufacturer's instructions
		CRAWLSPACE: Permanently attach crawlspace wall insulation to the walls. Cover exposed earth in unvented crawlspace with continuous vapor retarder with overlapping joints taped or masticed.
701.4.5.3		WALLS
		WINDOWS AND DOORS: install caulking, gasketing, adhesive flashing tape, foam sealant, or weatherstripping to form a complete air barrier

		BAND JOIST/RIM JOISTS: Insulate and seal band/rim joists
		BETWEEN FOUNDATION and SILL PLATE BOTTOM PLATE: Install sill sealer or other material that will expand and contract between foundation and sill plate. Install caulk (or equivalent) to seal the bottom plate of exterior walls
		SKYLIGHTS and KNEE WALLS: Insulate skylight shafts and knee walls to the same level as the exterior walls
		EXTERIOR ARCHITECTURAL FEATURES: Do not disrupt code-required building envelope insulation and air sealing at exterior architectural features such as stairs and decks
701.4.5.4		CEILING/ATTIC
		ATTIC ACCESS (except Unvented Attic): Cover and gasket attic access, knee wall door, or drop down stair with insulation. Knee wall door is insulated or is covered with insulation
		RECESSED LIGHTING: Ensure that recessed light fixtures are airtight, IC rated, and sealed with gasket, caulk, or foam, unless within the thermal envelope.
		EAVE VENTS: Utilize baffles or other means to minimize air movement into or under the insulation, for ceiling/attic assemblies or designs that have eave vents,
701.4.6		Install windows where the NFRC-certified U-factor and SHGC of windows, exterior doors, skylights, and tubular daylighting devices are in accordance with ENERGY STAR, or equivalent, or Table 701.4.6, except for decorative fenestration elements up to 15 square feet or 10% of the total glazing area, whichever is less
702		PERFORMANCE PATH
702.1		Points from Section 702 shall not be combined with points from Section 703
702.2		Implement energy efficiency features to achieve energy cost performance that exceeds IECC by:
		Documentation Required: Results of analysis using software in accordance with IECC Section 404 or Section 506.2 through 506.5 applied as defined in the IECC.
	1	15%
	2	30%
	3	50%
	4	60%
703		PRESCRIPTIVE PATH
703.1.1		Total building thermal envelope UA is less than required by Section 402.1.4 of IECC by the percentage specified in Table 703.1.1. When insulation is used, grading by a third party as Grade 1 insulation is required
		Documentation Required: Analysis Provided by RESCheck version 4.0.1 or later or equivalent based on a comparison to the IECC/IRC/IBC
703.1.2		Grade insulation by a third party (points not awarded if received in 703.1.1). Insulation Installation is graded as specified.
703.1.3		More than 75% of the above-grade exterior opaque wall area is mass walls
703.2		INSULATION AND AIR SEALING
703.2.1		Install insulation and air sealing in accordance with all of the following as applicable:

703.2.1.1		AIR BARRIER AND THERMAL BARRIER: Install thermal insulation in substantial contact with interior and exterior air barrier to provide continuous alignment of the insulation with the air barrier.
		--Air impermeable insulation is deemed to be its own Air barrier
		--ICFs, SIPS, and other wall systems provide their own air barrier, except at interfaces with other materials or assemblies, or penetrations
		--To qualify as its own air barrier, spray foam is 1) continuously attached to the top, bottom, and both sides of the cavity; 2)continuous in the cavity without any unrepaired breaks; and 3) air impermeable
		Voids or area of incomplete fill (less than 30% of full thickness) are not more than 2% of the insulated area
		Insulation is in substantial contact with sheathing materials on at least one side
		Any exterior rigid insulation is tightly fitted or interlocking at the joints
		PLUMBING AND WIRING
		Place insulation between the outside (ceiling, wall or floor) and the pipes at a minimum
		Batts: Insulation is split or cut to fit around wiring and plumbing
		Sprayed Wiring is fasted in place to prevent displacement. Insulation is sprayed to encapsulate pipes where the pipe temperature is less than 180 degrees F
		NARROW CAVITIES: fill narrow cavities and cut batts to fit
		HVAC boots that penetrate the building envelope are caulked or sealed to the subfloor or drywall
		FIREPLACE: Install masonry fireplace with gasketed doors, outside combustion air, and a chimney top damper
703.2.1.2		FLOOR/FOUNDATION/CRAWLSPACE
		Install air barrier at any exterior edge of insulation around floors
703.2.1.3		WALLS
		SHOWER/TUB at exterior wall: Insulate exterior walls behind the tub/shower, include an interior and exterior air barrier
		ELECTRICAL OUTLET BOXES:
		Air sealed type boxes are installed or the air barrier extends completely behind the boxes
		Insulation is placed between the sheathing and the rear of the electrical or phone boxes located on exterior walls
		Electrical outlet boxes are covered prior to spraying insulation
		COMMON WALLS BETWEEN DWELLING UNITS:
		Air barrier is installed to seal the gap between a gypsum shaft wall and the structural framing between units in duplex and townhouse construction
		SKYLIGHTS AND KNEE WALLS:
		Air seal skylight shafts and knee walls, and physically support insulation on them by stapling in place, netting or other mechanical attachment
		FIREPLACE WALL: Align air barrier with insulation and seal any gaps with caulk or foam
703.2.1.4		CEILING/ATTIC
		DROPPED CEILING/SOFFIT: substantially align air barrier with insulation and seal any gaps with caulk, foam, or tape

		ATTIC ACCESS (except Unvented Attic): Cover and gasket attic access, knee wall door, or drop down stair with insulation.
		WHOLE-HOUSE/UNIT FAN PENETRATION: Seal or gasket an insulated cover to the attic opening
703.3.1		The NFRC-certified U-factor and SHGC for windows, exterior doors, skylights, and tubular daylighting devices are in accordance with Table 703.3.2(a) or (b), except for decorative fenestration elements up to 15 square feet or 10% of the total glazing area, whichever is less
703.4.1		Install a combination space heating and water heating system using either a coil from the water heater connected to an air handler to provide heat for the dwelling unit, or a space heating boiler using an indirect water heater; devices shall have a combined annual efficiency of 0.80
703.4.2		Furnace and/or boiler efficiency is in accordance with one of the following
	1	Gas/Propane Heater
	2	Oil Furnace
	3	Gas Boiler
	4	Oil Boiler
703.4.3		Boiler equipped with temperature reset control or burner delay control
703.4.4		Install heat pump that has heating efficiency with Table 703.4.4 and refrigerant charge is verified to be in compliance with manufacturer's instructions
703.4.5		Cooling efficiency is in accordance with one of the following; refrigerant charge is verified to be in compliance with manufacturer's instructions
	1	Air Conditioner and Heat Pump Cooling
	2	Water Source/Cooled Air Conditioners
703.4.6		Install ground source heat pump by a Certified Geothermal Service Contractor in accordance with one of the following ENERGY STAR levels:
	1	Open loop, ≥ 16.2 EER, 3.6 COP
	2	Closed loop, ≥ 14.1 EER, 3.3 COP
	3	Direct Expansion, ≥ 15 EER, 3.5 COP
	4	Any Type, ≥ 24 EER, 4.3 COP
703.4.7		Install ENERGY STAR, or equivalent ceiling fans
703.4.8		Install whole-house fan with insulated louvers and a sealed enclosure
703.4.9		MULTI UNITS: Make information available on electricity/fossil fuel consumption by installing an advanced electric and fossil fuel submetering system
	1	Install a device providing monthly consumption information
	2	Install a device that can provide near real-time energy consumption information
703.4.10		Install ENERGY STAR or equivalent programmable thermostat
703.5		WATER HEATING DESIGN, EQUIPMENT, AND INSTALLATION
703.5.1		Ensure water heater Energy Factor (EF) greater than or equal to the following:
	1	Gas Water Heating
	2	Electric Water Heating
	3	Oil Water Heating
	4	Heat Pump Water Heating
703.5.2		Install a desuperheater by a qualified installer or is pre-installed in the factory
703.5.3		Install drain-water heat-recovery system in multi-family units

703.5.4		INSULATING HOT WATER PIPES
703.5.4.1		Insulate hot water lines with a minimum of R-4 insulation
703.5.4.2		Insulate boiler supply piping in unconditioned space
703.5.5		Install indirect fired water storage tanks heated from boiler systems
704		ADDITIONAL PRACTICES
704.1		Points from 704 can be added to points earned in 702, 703, or 701.1.3 Alternative Bronze Level Compliance
704.2		LIGHTING AND APPLIANCES
704.2.1		Ensure hard-wired lighting to meet the following
	1	50% of total hard-wired fixtures, or the bulbs in those fixtures, are ENERGY STAR or equivalent
	2	50% of the total hard-wired lighting fixtures qualify as ENERGY STAR or equivalent
	3	80% of the exterior lighting wattage has an efficiency of at least 40 lumens per watt or be a solar powered light fixture
704.2.2		Install recessed light fixtures that penetrate the thermal envelope in accordance with 701.4.5.4, less than 1 per 400 sq. ft. of total conditioned floor area
704.2.3		Install occupancy sensors on indoor lights, install photo or motion sensors on outdoor lights
	1	25% of lighting
	2	50% of lighting
704.2.4		Install tubular daylighting device or a skylight with insulated, low-E glass in rooms without windows
704.2.5		Install ENERGY STAR or equivalent appliances
	1	Refrigerator
	2	Dishwasher
	3	Washing machine
704.2.6		Install induction cooktop
704.2.7		Install occupancy sensors for a minimum of 80% of hardwired lighting outlets
704.3		RENEWABLE ENERGY/SOLAR HEATING AND COOLING
704.3.1.1		Sun-tempered Design Building orientation, sizing of glazing, and design of overhangs meet all:
	1	Long side of the building faces within 20 degrees of true south
	2	Vertical glazing area is between 5% and 7% of gross Conditioned Floor Area on the south face (see note 8, below)
	3	Vertical glazing area is less than 2% of gross Conditioned Floor Area on the west face, and glazing is ENERGY STAR compliant or equivalent
	4	Vertical glazing area is less than 4% of gross Conditioned Floor Area on the east face and glazing is ENERGY STAR compliant or equivalent
	5	Vertical glazing area is less than 8% of gross Conditioned Floor Area on the north face, and glazing is ENERGY STAR compliant or equivalent
	6	Where installed, skylights meet the following:
	a	Shades and insulated wells are used and all glazing meetings ENERGY STAR specs
	b	Horizontal skylights are less than 0.5% of Finished Ceiling Area

	c	Sloped skylights on slopes facing within 45 degrees of true South, East, or West are less than 1.5% of finished Ceiling area
	7	Overhangs or adjustable canopies or awnings or trellises provide shading on south facing glass for the appropriate climate zone
	8	the south face windows have a SHGC of 0.40 or higher (except 703.3.1)
	9	Return air or transfer grilles/ducts are in accordance with 704.4.5
704.2.1.2		Provide window shading with automated solar protection
704.3.1.3		Passive cooling design meets two or more of the following:
	1	Provide exterior shading on east and west windows using one or a combination of the following:
	a	Vine covered trellises
	b	Moveable awnings or louvers
	c	covered porches
	d	attached or detached conditioned/unconditioned enclosed space that provides full shade of east and west windows
	2	Overhangs meet 704.3.1.1(7) to provide shading on south-facing glazing
	3	Windows and/or venting skylights are located to facilitate cross ventilation
	4	Solar reflective roof or radiant barrier is installed in Climate Zones 1,2,or 3. Roof material meets a 3 year aged criteria of 0.50
	5	Internal exposed thermal mass is a minimum of three inches in thickness. Thermal mass consists of concrete, brick, tile that are fully adhered to masonry base or other masonry material and is in accordance with one or more of the following:
	a	One square foot of exposed thermal mass in floor per three square feet of gross finished floor area
	b	Three square feet of exposed thermal mass in interior walls or elements per square foot of gross finished floor area
	6	Roofing material is installed with a minimum 3/4" continuous air space offset from the roof deck from eave to ridge
704.3.1.4		Passive solar heating design, implement all of the following
	1	Additional glazing is permitted on the south wall and is no greater than 12%
	2	Additional thermal mass for an room with south-facing glazing of more than 7% of the Finished Floor Area with the following:
	a	Thermal mass must be solid and at least 3" thick, and fully adhered to each other if two materials are layered together
	b	Thermal mass directly exposed to sunlight must meet certain ratios
	c	Thermal mass not directly exposed to sunlight can be used to meet certain thermal mass ratios
	3	Provision for forced airflow to adjoining areas are implemented as needed in addition to the pressure balanced air for the entire home required I 704.3.1.1
704.3.2		SOLAR WATER HEATING
704.3.2.1		Install solar water heating system to SRCC ratings
704.3.3		ADDITIONAL RENEWABLE ENERGY OPTIONS
704.3.3.1		Install Photovoltaic panels on the property, points awarded per kW
704.3.3.2		Install other onsite renewable energy sources such as wind energy, onsite micro-hydro power, or active solar space heating systems, points awarded per kW

704.4		DUCTS
704.4.1		Design and install duct system according to ACCA Manual D or equivalent
704.4.2		Space heating is provided by a system that does not include air ducts
704.4.3		Provide space cooling by a ductless system
704.4.4		Build ductwork according to all:
	1	Building cavities are not used as return ductwork
	2	Heating and cooling ducts and mechanical equipment are installed within the conditioned building space
	3	Ductwork is not installed in exterior walls
704.4.5		Install return ducts or transfer grilles in every room with a door except baths, kitchens, closets, pantries, and laundry rooms
704.5		HVAC DESIGN AND INSTALLATION
704.5.1		Select ACCA (Manual S) to select heating and/or cooling equipment
704.5.2		Use an HVAC contractor and service technician that are certified by a nationally or regionally recognized program such as NATE, BPI, Radiant Panel Association, or manufacturers' training program
704.5.3		Have HVAC contractor verify the heating/cooling system performance with all:
	1	Start-up procedure is performed according to manufacturer's instruction
	2	Refrigerant charge is verified by super-heat and/or sub-cooling method
	3	Burner is set to fire at nameplate input
	4	Air handler setting/fan speed is set per manufacturer's instructions
	5	Total air flow is within 10% of design flow
	6	Total external system static does not exceed equipment capability at rated airflow
704.5.4		HVC equipment operates using an alternate refrigerant containing no HCFCs
704.5.5		Manufacturer's label or printed specifications for sealed air handler (excluding furnaces) indicates $\leq 2\%$ of design air flow pressure, tested with inlets, outlets, and condensate drain ports sealed and filter box in place
704.6.1		Conduct 3rd party onsite inspection, with all
	1	Ducts installed per IRC/IMC and duct sealing is performed
	2	Building envelope air sealing is performed
	3	Insulation is installed in conformance with requirements of Section 703.1.2
	4	Windows, skylights, and doors are flashed, caulked, and sealed with manufacturer's recommendations, according to 703.2.1
	5	Minimum of two inspections are performed. One inspection after insulation is installed and prior to being covered, and another inspection upon completion of the project
704.6.2		Third party testing to verify performance
704.6.2.1		Demonstrate building envelope leakage rate by blower door test, and perform:
	1	Mechanical ventilation is provided in accordance with 902.5
	2	Fossil fuel furnace and water heater is sealed combustion or power vented according to 801.1
	3	Fireplaces and Fuel Burning Appliances are in accordance with 901.2, maximum leakage rate:
	a	5 ACH50

	b	4 ACH50
	c	3 ACH50
	d	2 ACH50
	e	1 ACH50
704.6.2.2		Test entire central HVAC duct system - maximum leakage
	a	Ductwork entirely outside building thermal envelope: 6%
	b	Ductwork entirely inside the building thermal envelope: 6%
	c	Ductwork both inside and outside the building thermal envelope: 6%
704.6.2.3		Demonstrate balanced HVAC air flows by flow hood or other acceptable flow measurement tool test that meet:
	a	Measured flow at each supply and return register is within 25% of design flow
	b	Total air flow is within 10% of design flow
705		INNOVATIVE PRACTICES
705.1		Install a whole house device that can control or monitor energy consumption
	1	Programmable communicating thermostat
	2	Energy monitoring device
	3	Energy management control system
705.2		Renewable energy service plan meets:
	1	Builder selects a renewable energy service plan provided by the local electrical utility for interim (temp) electrical service, the builder's local administrative office has renewable energy service
	2	The buyer of the home selects a renewable energy service plan provided by the utility prior to occupancy of the home

Appendix H: MN GreenStar New Home Non-Mandatory Credits Related to Energy Efficiency

Minnesota GreenStar New Home	
Non-mandatory Credits Related to Energy Efficiency	
1A--1	Create multi-disciplinary project team, including homeowner, contractor and all subcontractors and include each in design and pre-construction meetings.
1A--2	Post-construction meeting for contractor, homeowner, and key subcontractors to review performance and lessons learned.
1A--3	Attendance at 8-hour MN GreenStar training by designer/architect from project team
1B--	Design
1B--1a	70-74
1B--1b	65-69
1B--1c	60-64
1B--1d	50-59
1B--1e	40-49
1B--1f	30-39
1B--1g	20-29
1B--1h	< 20
1B--2	Estimate carbon emissions of operating home (use MN GreenStar calculator)
1B--5	Passive solar heating design package (includes orientation, south glazing/floor area ratio orientation specific low-e tuning, summer shading and thermal mass design)
1B--6	Passive cooling design package (including orientation, summer shading, attic ventilation, additional ceiling fans, heat recovery ventilation and natural ventilation design)
1B--7	Demonstrate systems approach to home design such as coordinated ductwork and framing
1B--11	Install vestibule with two gasketed self-closing doors and walk-off mat between living space and garage
2	Location
2A--	Development Certification
2B--	Site Selection
2C--	Infrastructure
2D--	Community, Transportation & Open Space
3	Site and Landscape
3A--	Soil and Permeability
3A--4	Keep excavated soils on site.
3B --	Planting/Trees
3B --10	Edible landscape planting/food garden is installed
3B --14a	Design around or install coniferous plantings suitable as a wind block on North side of home. (Do not block solar access of neighbor)
3B --14b	Design around or install deciduous plantings suitable for summer shading and winter heating on East, and/or South and/or West side of home.
3C --	Irrigation
3D --	Decks, Patios and Porches

3E --	Erosion Control
3F --	Rainwater Harvest
3F --2a	20%
3F --2b	50%
3F --2c	90%
3G --	Grading/Drainage
4	High Floor, Wall, Ceiling & Roof Assemblies Performance
4A --1	Infrared thermographic inspection
4B --	New Foundations, Crawlspace & Slab Floor Assemblies
4B --3a	R-5 rigid insulation at edge and under entire basement floating floor slab. (assumes NO in-floor radiant heat)
4B --3b	R-10 rigid insulation at edge and under entire basement OR on grade floating floor slab. (suitable for in-floor radiant heat) (see manual for exceptions)
4B --3c	R-15 rigid insulation at edge and under entire basement OR on grade floating floor slab. (suitable for in-floor radiant heat) (see manual for exceptions)
4B --4a	R-5 continuous exterior foundation insulation. Top of foundation to top of footing or frost depth, which ever is greater).
4B --4b	R-10 continuous exterior foundation insulation. Top of foundation to top of footing or frost depth, which ever is greater).
4B --4c	R-15 continuous exterior foundation insulation. Top of foundation to top of footing or frost depth, which ever is greater).
4B --6a	25% to 39%
4B --6b	40% or more
4B --14	Foundation built with insulated concrete forms (ICF) or Insulated concrete "T" Mass or equivalent system with a minimum of R14
4B --15	Insulated pre-cast concrete foundation system is used w/ min. R-10 Insulation.
4B --22	Air seal and insulate foundation to R-15 or better on interior.
4B --23	Use spray foam to air seal and insulate interior foundation walls and rim joists. Note: If foundation cannot dry to exterior above grade through minimum of 16" of exposed foundation and/or rim joist area is not separated from foundation by a capillary break, then closed cell foam insulation CANNOT exceed the thickness that would reduce its vapor permeability to 1 perm or less.
4C --	New Exterior Walls Above Grade, All New Non-Slab (framed) Floors, All New Interior Partition Walls & All New Ceilings
4C --6c	Structural Insulated Panels (SIP) (min. 80% exterior walls)
4C --6d	Structural Insulated Panels (SIP) (min. 80% roofs)
4C --7	Insulated Concrete Forms (ICF) or Insulated Concrete "T" Mass walls are used for exterior above grade. (min.90%)
4C --8a	19.2" or 24" o.c. framing
4C --8b	2 stud corners with drywall clips
4C --8f	Insulated T-wall framing used at intersection of interior and exterior walls

4C --9c	Spray foam insulation applied in new studs
4C --9e	Weighted R-value of wall assemblies R20 to R21
4C --9f	Weighted R-value of wall assemblies R22 to R25
4C --9i	Rim joist connecting two conditioned floors are insulated to greater than R-23
4C --9j	Floor over unheated space insulated to minimum R38
4C --9k	Insulated headers (minimum of 80% of new headers)
4C --10a	Bottom plates of exterior walls sealed to floor or foundation with a proper sealant
4C --10b	Seams and penetrations in rim joist between conditioned floors are sealed
4C --10c	Seal rim joists at all locations and connection with attic at exterior walls
4C --10d	Air seal penetrations and joints in fireplace framing
4C --10e	Cantilevered floor sealed above supporting wall
4C --10f	Stud cavities are blocked at locations of varying ceiling height, such as in common walls between adjacent rooms
4C --10g	Seal all gypsum or magnesium board penetrations in exterior walls using caulk, gaskets or appropriate connection with gypsum board
4C --10h	Seal drywall at top plate, bottom plate and penetrations with gasket, sealant or glue
4C --10i	Exterior sheathing with no gaps larger than 0.25 inches
4D --	New Windows, Skylights & Doors
4D -- PR1	New window and door units must meet energy code.
4D -- PR2	Windows and Glass doors must be ENERGY STAR and National Fenestration Rating Council (NFRC) labeled
4D -- PR3	Flash windows and exterior doors with pan, side & head flashing. Integrate with wind wash barrier of wall.
4D -- PR4	Air seal around outside of window and door units with low expansion foam insulation. (maintain drainage void at base of window)
4D -- PR5	Connecting doors between living space and garage are self closing and $\leq 0.30\text{cfm/sq.ft.}$ air leakage rating.
4D --1a	Windows and/or skylights have a U-factor of 0.29 to 0.32
4D --1b	Windows and/or skylights have a U-factor of 0.25 to 0.29
4D --1c	Windows and/or skylights have a U-factor of 0.24 or less
4D --1g	Window and/or skylight air leakage rating $< 0.30\text{ cfm/s.f.}$
4D --1h	East/west facing windows and/or skylights have SHGC ≤ 0.35
4D --1i	Install Northern Glass on Southern exposures
4D --1j	Add exterior shading to new windows on south and west side of home, such as awnings on south or west, vertical fins on west, etc.
4D --1k	Install storm windows on double hung or fixed windows
4D --2	West facing glazing within 30° of west $\leq 2\%$ of floor area (cannot take with passive solar credits 1B-5 or 1B-6)
4D --3	East facing glazing within 30° of east $\leq 3\%$ of floor area (cannot take with passive solar credits 1B-5 or 1B-6)
4D --4	North facing glazing within 30° of north $\leq 8\%$ of floor area (cannot take with passive solar credits 1B-5 or 1B-6)
4D --4	Install Energy Star light tubes to bring light to interior areas that receive limited daylight

4D --5	Install, adjustable interior solar shades, or reflective blinds to min. 90% of all east, west, and south windows/skylights which have no exterior shading to block summer sun.
4D --7a	Door(s) with 1/2 glass or less (min. 90% of all doors of this type) U-factor is 0.18 to 0.20
4D --7b	Door(s) with 1/2 glass or less (min. 90% of all doors of this type) U-factor is ≤ 0.17 .
4D --7c	Door(s) with 1/2 glass or more (min. 90% of all doors of this type) U-factor is 0.31 to 0.47.
4D --7d	Door(s) with 1/2 glass or more (min. 90% of all doors of this type) U-factor is ≤ 0.30 .
4D --7i	Install storm door at all entries. (sliding doors exempt)
4E --	New Attics & Roofs
4E --6b	Structural Insulated Panels (SIP) (min. R38) (min. 80% roofs)
4E --7a	19.2" or 24" o.c. roof framing
4E --8c	Spray foam insulation applied for air seal over entire attic floor. (R14 min.)
4E --8d	Attic insulation total R44 to R49 (flat or vaulted)
4E --8e	Attic insulation total R50 or more (flat or vaulted)
4E --8f	Add 1" min. foil face polyisocyanurate insulation to sloped roof / ceiling for thermal break and vapor barrier
4E --8g	Add 2" rigid insulation to interior of sloped roof / ceiling for thermal break and vapor barrier
4E --8h	Energy Heel: min. R38 to outside face of exterior walls
4E --8i	Access openings to new attics and new knee wall areas are well insulated Horizontal Attic Access = R38 min & Vertical Knee Wall Access = R23 min.
4E --8j	Knee wall in finished attic insulated to R30 (no knee wall also qualifies)
4E --9a	Seal all attic by-passes (spot seal with foam or caulk --OR-- spray foam entire attic floor)
4E --9b	Access openings to new attics and new knee wall areas are weatherstripped
4E --9c	Provide insulation wind baffle or other air barrier to block wind washing at all attic eave bays in roof assemblies with soffit vents
4E --10h	Roofing material with ENERGY STAR Cool Roof certification. (90% min. of roof area)
4E --11a	16" to 23"
4E --11b	24" to 31"
4E --11c	32" or more
4E --12	Install roof gutters to discharge water 5' away from any foundation or, in limited spaces, deposit into underground pipe that carries water min. 10 feet from foundation
4E --13	Design and specify balanced roof ventilation system. (Non-vented "Hot" roofs also qualify if drawings are included to show critical details. i.e. @ roof / wall intersections.)
4E --14	Implement design from 4E -13. Install-new eave vents, vent chutes, roof vents, etc ---OR--- Implement non-vented strategy. (Non-vented designs must be pre-approved by building code official.)
5	MECHANICALS
5A --	Ventilation and Fresh Air for Occupants

5A --1b	range hood > 300 cfm
5A --1d	fan is ENERGY STAR qualified
5A--5	Install garage exhaust fan that is ENERGY STAR rated and runs continuously at min. 25 CFM. OR If it has intermittent operation, (i.e. controlled by a motion sensor or programmable timer), 100 CFM is required (attached garage only).
5A--7	High efficiency whole house fan installed with R-42 minimum insulated cover (open windows and/or doors to prevent backdrafting).
5A--8	Heat recovery ventilator (HRV) installed
5A--9	Energy recovery ventilator (ERV) installed
5A--10	All outdoor air intakes for ventilation located at least 10' away from air exhaust outlets and areas where vehicles may be idling.
5A--11	Install large media filter
5B --	Moisture and Relative Humidity
5B --2	Installation of ENERGY STAR dehumidifier equipped with humidity sensor. (Portable, Stand-alone & HVAC integrated qualify)
5C --	HVAC DISTRIBUTION STRATEGIES
5C --1a	Air leakage < 8%
5C --1b	Air leakage < 5%
5C --1c	Air leakage < 3%
5C --3a	All ductwork kept in conditioned space and interior walls. Ductwork allowed in vaulted ceiling provided it stays on the conditioned side
5C --3b	Design appropriate duct system using ACCA Manual D.
5C --3c	All supply duct take-offs spaced 6" apart minimum
5C --3d	All ductwork to be rigid or flex pulled tight
5C --3e	Furnace located to minimize length of duct runs
5C --3f	Ductwork sealed with water-based, low-VOC (<30 g/l) mastic or aerosol sealant
5C --3g	Boiler located to minimize length of supply lines.
5C --5	Seal HVAC cabinet seams, and all seams of plenums and duct-work with mastic. Install gaskets on cabinet doors if possible.
5C --6	Rooms and zones have balanced air flow. +/- 3 pascals relative to the outdoors or adjacent rooms caused by any single or combination of fans or blowers.
5D --	Heating and Cooling Equipment
5D --1	Design and install heating a cooling equipment according to manual J calculations.
5D --2a	Meets ENERGY STAR (≥ 15 SEER, ≥ 8.2HSPF, ≥ 90 AFUE Furnace, ≥ 85 AFUE Boiler. See manual for heat pump values.)
5D --2b	Better than ENERGY STAR (≥ 16 SEER, ≥ 8.6HSPF, ≥ 92 AFUE Furnace, ≥ 87 AFUE Boiler. See manual for heat pump values.)
5D --2c	Substantially better than ENERGY STAR (≥ 17 SEER, ≥ 9.0HSPF, ≥ 94 AFUE Furnace, ≥ 90 AFUE Boiler. See manual for heat pump values.)
5D --3	Install ground source heat pump
5D --4	Install multiple zones in home to improve energy efficiency.
5D --5	Install hydronic in-floor heating system connected to heat source that has at least 80% AFUE boiler. Connecting to ground source heat pump or hot water solar systems also qualify.

5D --6	Furnace is equipped with an electronically commutated fan motor (ECMs) -- (variable speed motor)
5D --8	Verify proper refrigerant charge by HVAC contractor
5D --9	House does not have A/C system and designed to provide passive cooling.
5D --10	Measured airflow of new equipment within 10% of manufacturer's specifications
5D --12	Install an aquastat control (for hot water boilers only)
5D --13	Install a Time-Delay Relay (for hot water boilers only)
5E --	Miscellaneous Mechanical
5E --1	Do not install a decorative fireplace or stove of any kind
6	ELECTRICAL
6A --	Appliances
6A --1a	Refrigerator
6A --1b	Room air conditioner
6A --1c	Dishwasher
6A --1e	Clothes washer
6A --2a	Refrigerator
6A --2b	Room air conditioner
6A --2c	Dishwasher
6A --3a	Refrigerator
6A --3b	Clothes washer
6A--4	Install gas cook top
6A--5	Install induction cook top
6A--6	Install gas dryer
6A--7	Number of energy consuming electrical appliances is 5
6A--8	Number of energy consuming electrical appliances is 4 or less
6A--9	Install an outdoor clothesline
6A--10	Provide switched outlets to dedicated media centers and home offices
6B --	Fans, Fixtures and Lights
6B--1ai	50%
6B--1aii	90%
6B--1bi	50%
6B--1bii	90%
6B--1ci	50%
6B--1cii	90%
6B--2	Halogen fixtures make up 30% of fixtures where CFL or LED fixtures are not used
6B--3	Install CFL bulbs in 50% of whole house
6B--4	Install CFL bulbs in 90% of whole house
6B --5	Install CFL bulbs in all recessed can light fixtures
6B--6	Install LED bulbs in all recessed can light fixtures
6B--7	Install three LED light fixtures
6B--8	Install six LED light fixtures
6B--9	Install LED light fixtures in 50% of high use rooms
6B--10	Install LED light fixtures in 90% of high use rooms
6B--11	Limit total indoor lighting to less than 0.5 watts per square foot
6B--12	Install dimmers on all lights in high-use rooms where compact fluorescent lights are not installed

6B--13	Install dimmers on all lights in medium/low-use rooms where compact fluorescents lights are not installed
6B--14	Install automatic indoor lighting controls in all high-use rooms
6B--15	Install automatic indoor lighting controls in all medium/low-use rooms
6B--16	No recessed light fixtures installed in any part of the house
6B--17	No recessed light fixtures in insulated ceilings
6B--18a	1 Room
6B--18b	2 Rooms
6B--18c	3 or more rooms
6B--18d	4 Rooms
6B--18e	5 or more rooms
6B --19	Solar powered walkway or outdoor lighting (minimum 70%)
6B --20	Install automatic outdoor lighting controls or photocells/timers
6B--22	Limit outdoor lighting to total maximum of 100 watts
6C --	Wiring
6C--2	Ceiling fan pre-wires provided in habitable rooms (min 2 pre-wires not including bedrooms)
6C--7	Photovoltaic ready home: Install wiring conduit for future PV installation & provide a minimum 200 s.f. within 15° of south with a roof angle of 30°-50°.
6D--	Electrical Systems
6D--1	Homeowner signs up for 100% wind power from local electric utility (if available)
6D--2a	One kilowatt
6D--2b	Two kilowatts or greater
6D--2a	Five kilowatts to nine kilowatts
6D--2b	Ten kilowatts or greater
7	WATER - PLUMBING, SYSTEMS AND FIXTURES
7A --	Equipment
1b	Install tankless water heater (elec)
7A--1c	Install tankless water heater (gas)
7A--1d	Install a high efficiency 88% min. tankless water heater
7A--1e	Install a heat trap or demand valve on water heater
7A--1f	Install a hot water demand re-circulation pump for homes with hot water runs of greater than 100'
7A--1g	Install a drain water heat recovery unit (DHR)
7A--2	Install water heater timer on any tank water heater
7B--	Fixtures
7B--3	Install an NSF certified reverse osmosis filter on all drinking water source
7C--	Piping
7C--2	Install circulation loop within 10' of each fixture (except utility sink)
7C--3	Insulate all hot water lines to minimum R-4
7C--4	Install water heater pipe insulation for first 20' of pipe
7C--5	Install water heater jacket on hot water heater (min. R-8)
7C--6	Centralize water heater, place as equidistant from fixtures as possible
7C--7	Install central manifold for distribution with minimum R-4 on all hot water lines
7D--	Water Systems
7D--3	Install solar domestic water heating system (min. 50% of water heating load)
7D--4	Install heat-pump system that is combined with water heating system

7D--5	Provide south roof area for future domestic solar hot water heating system (min. 30 sf within 15° of South with a roof angle of 30°-50°) and plumbing rough-in for solar water heating system
7D--8	No garbage disposal
8	FINISH MATERIALS AND COATINGS
8A --	Wall Coverings and Ceiling Materials
8A--1	Install plaster and lathe on walls and/or ceilings
8A--5a	Locally sourced
8A--6a	Locally sourced
8B--	Flooring
8B--8a	Locally sourced
8B--9a	Locally sourced
8C --	Millwork and Doors
8C--1a	Locally sourced
8C--2a	Locally sourced
8C--4a	Locally sourced
8C--5a	Locally sourced
8D --	Countertops
8D --1a	Locally sourced
8D --2a	Locally sourced
8E--	Cabinetry
8E--1a	Locally sourced
8F--	Coatings and Adhesives
9	WASTE MANAGEMENT
9A --	Construction Waste
9A--10	Job site framing plan and cut list
9B --	Homeowner Waste Reduction
10	EDUCATION
10A --	Homeowner and Subcontractor Education
10A --1	Expand homeowner's user manual
10A--3	Homeowner given a walk through education during framing to explain design and construction of their home.
10A--4	Educate the homeowner on the ENERGY STAR labeling system and explain the need for all appliances replaced in the future to be ENERGYSTAR rated
11	INNOVATION
11A --	Performance Design and Alternative Methods
11A --1	Trees removed for construction are milled and incorporated in the project
11A2	Use alternative building systems, e.g., Durasol, Fasswall, Autoclaved Aerated Concrete
11A --3	Cold climate appropriate natural building system (e.g. straw bale, cordwood, etc)
11A --5	Air and moisture barrier at exterior
11A --7	Submit one year's worth of utility usage data to MN GreenStar after completion of home. (See attached "Utility Tracking Table 11A--7)
11B --	Design for Reduced Electrical and Magnetic Fields
11B --7	Install dedicated circuit with shut off switch for all outlets that will have constant draw machines outside of media rooms (media rooms are covered under 4A--7)

11B --12	Install alternative to electronic dimmer light switches, e.g. rheostat, on/off switch or 3 way bulb that switches from 50 to 100 to 150 watt.
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Appendix I: NGBS Credits Related to Water Efficiency

NGBS Credits Related to Water Efficiency		
801		INDOOR AND OUTDOOR WATER USE
801.1		Reduce hot water use by one of the following:
	1	All hot water piping which runs to the kitchen and bathrooms shall be 40ft or less in length from the water heater, shall be sized according to code
	2	All hot water piping which runs to the kitchen and bathrooms shall be 30ft or less in length from the water heater, shall be sized according to code
	3	Implement one of the following piping system designs:
	a	Use of structured plumbing with demand controlled hot water loops, in which the volume of water contained in the pipe and fixture fittings downstream of the recirculating trunk line is no more than 4 cups (28.9 cubic inches = 0.125 gallons) or
	b	Implement an engineered parallel piping system (i.e. manifold system) in which the hot water line distance from the water heater to the parallel piping system is less than 15 feet, and the parallel piping to the fixture fittings contains no more than 8 cups (58 cubic inches=0.25 gallons) or
	c	Use of a central core plumbing system with all plumbing fixture fittings (faucets & showerheads) located such that the volume of water contained in each pipe run between the water heater and fixture fitting is no more than 6 cups (43.3 cubic inches=0.2 gallons)
	4	Over 40-feet of pipe run from water heater to fixture locations is aided by one of the following:
	a	Tankless water heater is installed at point of use and is served only by cold water or a solar-assisted system
	b	On demand hot water recirculation system is installed
801.2		Install ENERGY STAR or equivalent water-conserving appliances
	1	Dishwasher
	2	Washing machine
	3	Washing machine with a water factor of 6.0 or less

801.3			Install at least one food waste disposer attached to the primary kitchen sink
801.4			Install showerheads so that flow rate is tested at 80 psi per ASME A112.18.1/CSA B125.1, and is equipped with automatic compensating valve that complies with prior and ASSE 1016, and provides thermal shock and scald protection
	1		1.0 to less than 2.5 gpm
	2		1.6 to less than 2.0 gpm
801.5			Install water-efficient lavatory faucets with flow rates of 1.5 gpm or less
801.6			Water closets and urinals according to the following:
		a	Water closets: Flush volume of 1.28 gallons or less, and comply with WaterSense Tank-Type High-Efficiency Toilet
		b	Urinal: Flush volume 0.5 gallons or less
801.7			Install a low-volume irrigation system for each landscape type utilized
	1		High distribution uniformity rotating spray heads
	2		Drip irrigation
	3		Bubblers
	4		Drip emitters
	5		Soaker hose
	6		Subsurface irrigation
			Points awarded once for each type of irrigation system, Max 10 points
801.8			Irrigation system is professionally designed and installed to meet the EPA WaterSense requirements or equivalent.
801.9			Zone irrigation separately for turf and bedding areas
801.10			The irrigation system is controlled by a smart controller
	1		Evapotranspiration based irrigation controller with a rain sensor
	2		Soil moisture sensor based irrigation controller
	3		No irrigation is installed and a landscape plan in compliance with 503.5 is developed
801.11			Collect and distribute rainwater
	1		Rainwater is collected and used
	2		Distribute rainwater using a renewable energy source or gravity
801.12			Install a self-closing valve, motion sensor, metering, or pedal-activated faucet to enable intermittent on/off operation
801.13			Install whole house filter to improve water quality
802			INNOVATIVE PRACTICES
802.1			Separate and reuse gray water as specified by Appendix O of the IRC, as permitted by local code

	1	Each water closet flushed by reclaimed or recycled water
	2	Irrigation from reclaimed or recycled water onsite
		Points not taken for both
802.2		Install composting or waterless toilet
802.3		Install one of the following automatic shut off water supply devices
	1	Excess Water Flow Shutoff
	2	Leak Detection System

Appendix J: MN GreenStar New Home Non-Mandatory Credits Related to Water Efficiency

Minnesota GreenStar New Home

Non-mandatory Credits Related to Water Efficiency

1A--1	Create multi-disciplinary project team, including homeowner, contractor and all subcontractors and include each in design and pre-construction meetings.
1A--2	Post-construction meeting for contractor, homeowner, and key subcontractors to review performance and lessons learned.
1A--3	Attendance at 8-hour MN GreenStar training by designer/architect from project team
3	Site and Landscape
3A--	Soil and Permeability
3A --1	Soil tested and amended to achieve optimal nutrient level and structure
3B --	Planting/Trees
3B --4	Plantings are compatible with soil type
3B --9	Low-water/no-mow mix is used on 100% of turf areas
3C --	Irrigation
3C --1	Develop landscape maintenance plan
3C --2	Landscape system that requires no municipally-supplied or well water for irrigation (food gardens exempt) (certified by registered professional)
3C --3	Use re-claimed material for deck, porch or patio (80%)
3C--4a	40%
3C--4b	60%
3C--4c	90%
3C--5	Use irrigation specialist certified through EPA WaterSense program
3C--6	Irrigation system that zones turf and bedding areas separately
3C--7	Hydro zoning
3C--8a	Install drip system
3C--8b	Use drip system with moisture/rain sensor
3C--8c	moisture/rain sensor
3C--9	Install greywater irrigation system
3D --	Decks, Patios and Porches
3E --	Erosion Control
3E --2	Apply mulch to at least 3 inches of all planting beds (no cypress mulch allowed)
3E --5	Native landscaping is planted along 80% of shoreline
3F --	Rainwater Harvest
3F --1a	20%
3F --1b	50%
3F --1c	90%
3G --	Grading/Drainage
3G-- 2	Retill top twelve inches of soil after construction

3G--8	Drainage system at base of garage and driveway that captures run-off and keeps it on-site
4	High Performance Floor, Wall, Ceiling & Roof Assemblies
4C --	New Exterior Walls Above Grade, All New Non-Slab (framed) Floors, All New Interior Partition Walls & All New Ceilings
4C --6b	Wood framed panels (min. 80% of exterior walls)
4C --6c	Structural Insulated Panels (SIP) (min. 80% exterior walls)
4C --6d	Structural Insulated Panels (SIP) (min. 80% roofs)
4C --7	Insulated Concrete Forms (ICF) or Insulated Concrete "T" Mass walls are used for exterior above grade. (min.90%)
4D --	New Windows, Skylights & Doors
4E --	New Attics & Roofs
4E --6a	Wood framed panels (min. 80% of roofs)
4E --6b	Structural Insulated Panels (SIP) (min. R38) (min. 80% roofs)
6	ELECTRICAL
6A --	Appliances
6A --1e	Clothes washer
6A --2c	Dishwasher
6A --2d	Clothes washer
6A --3b	Clothes washer
7	WATER - PLUMBING, SYSTEMS AND FIXTURES
7A --	Equipment
7A--1e	Install a heat trap or demand valve on water heater
7A--1f	Install a hot water demand re-circulation pump for homes with hot water runs of greater than 100'
7B--	Fixtures
7B--3	Install an NSF certified reverse osmosis filter on all drinking water source
7B--4	Limit shower heads to one per shower
7B--5	Install shower heads with very low flow (max 2.0 gpm)
7B--6	Install shower heads with ultra low flow (max 1.5 gpm)
7B--7	Replace/install shower heads with ultra low flow (max 1.0 gpm)
7B--10	Install very-low flow dual flush toilets (.8/1.6 gpf) or pressure assist (1.1 gpf) toilet (min.75%)
7B--11	Install new toilets with 1.2gpf (min. 75%)
7B--12	Install composting toilet
7B--13	Install all faucets or add aerators with low flow (max 2.2 gl/mn)
7B--14	Install all faucets or add aerators with very low flow (1.5 gl/mn)
7B--15	Install all faucets or add aerators with ultra low flow (1.0 gl/mn)
7B--16	Replace all faucets or add aerators with low flow (.5 gl/mn)
7B--17	Shut off valve, motion sensor, or pedal activated faucet to enable intermittent on/off operation (kitchen or lavatory)
7C--	Piping
7C--2	Install circulation loop within 10' of each fixture (except utility sink)

7C--6	Centralize water heater, place as equidistant from fixtures as possible
7C--7	Install central manifold for distribution with minimum R-4 on all hot water lines
7C--8	Perform a water leak test and remediate leaks discovered
7D--	Water Systems
7D--1	Install a greywater collection system that annually captures and reuses a minimum of 50% of home's greywater
7D--8	No garbage disposal
8	FINISH MATERIALS AND COATINGS
8A --	Wall Coverings and Ceiling Materials
8A--6d	Low emitting or no-added-formaldehyde
8B--	Flooring
8B--8d	Low emitting or no-added-formaldehyde (NAF) (see requirements)
8B--9d	Low emitting or no-added-formaldehyde (NAF) (see requirements)
8C --	Millwork and Doors
8D --	Countertops
8E--	Cabinetry
8F--	Coatings and Adhesives
9	WASTE MANAGEMENT
9A --	Construction Waste
9A--4	Composting portable toilet on work site
9B --	Homeowner Waste Reduction
10	EDUCATION
10A --	Homeowner and Subcontractor Education
10A --1	Expand homeowner's user manual
10A--3	Homeowner given a walk through education during framing to explain design and construction of their home.
11	INNOVATION
11A --	Performance Design and Alternative Methods
11A2	Use alternative building systems, e.g., Durasol, Fasswall, Autoclaved Aerated Concrete
11A --3	Cold climate appropriate natural building system (e.g. straw bale, cordwood, etc)

Appendix K: NGBS Credits Related to Indoor Environmental Quality (IEQ)

			NGBS Credits Related to IEQ
901.1			Space and water heating options
901.2			Fireplaces and fuel burning appliances [Mandatory Practice]
901.2.1(2)(a)			Wood burning fireplaces
901.3			Garages [Mandatory Practice]
901.4(1)			Structural plywood & OSB [Mandatory Practice]
901.4(2)			Wood materials
901.5			Carpets [Mandatory Practice]
901.6			Hard-surface flooring
901.7			Wall coverings
901.8			Architectural coatings
901.9			Adhesives and sealants
901.10			Cabinets
901.11			Insulation
901.12			Carbon monoxide (CO) alarms
901.13			Building entrance pollutants control
902.1			Spot ventilation [Mandatory Practice]
902.1.4			ENERGY STAR® exhaust fans
902.2			Building ventilation systems
902.3			Radon control [Mandatory Practice]
902.4			HVAC system protection
902.5			Central vacuum systems
902.6			Living space contaminants
903.1			Tile backing materials [Mandatory Practice]
903.2			Capillary breaks [Mandatory Practice]
903.3			Crawlspaces [Mandatory Practice]
903.4			Moisture control measures [Mandatory Practice]
903.5			Plumbing
903.6			Duct Insulation [Mandatory Practice]
903.7			Relative Humidity
904.1			Humidity monitoring system
904.2			Kitchen exhaust

Appendix L: MN GreenStar New Home Non-Mandatory Credits Related to Indoor Environmental Quality (IEQ)

Minnesota GreenStar New Home

Non-mandatory Credits Related to IEQ		
1A--	Integrated Project Team	
1A--1	Create multi-disciplinary project team, including homeowner, contractor and all subcontractors and include each in design and pre-construction meetings.	
1A--2	Post-construction meeting for contractor, homeowner, and key subcontractors to review performance and lessons learned.	
1A--3	Attendance at 8-hour MN GreenStar training by designer/architect from project team	
1B--	Design	
1B--1	Improved HERS Index Score.	Select HERS Score:
1B--11	Install vestibule with two gasketed self-closing doors and walk-off mat between living space and garage	
3	Site and Landscape	
3A--	Soil and Permeability	
3A --1	Soil tested and amended to achieve optimal nutrient level and structure	
3C --	Irrigation	
3C --1	Develop landscape maintenance plan	
4	High Floor, Wall, Ceiling & Roof Assemblies	Performance
4B --	New Foundations, Crawlspace & Slab Floor Assemblies	
4B --1	Install 4" bed of 3/4" diameter or greater clean or washed gravel on top of basement and/or crawlspace soil before any other flooring work is done.	
4B --4a	R-5 continuous exterior foundation insulation. of footing or frost depth, which ever is greater).	Top of foundation to top
4B --4b	R-10 continuous exterior foundation insulation. of footing or frost depth, which ever is greater).	Top of foundation to top
4B --4c	R-15 continuous exterior foundation insulation. of footing or frost depth, which ever is greater).	Top of foundation to top
4B --7	Low toxicity form release agents used on concrete form work	
4B --9	Install 4" min. perforated foundation drain w/ 3/4" gravel and filter fabric at <u>outside</u> perimeter of new footings. (top of tile below bottom of interior slab floor)	
4B --10	Install 4" min. perforated foundation drain w/ 3/4" gravel and filter fabric at <u>inside</u> perimeter of new footings.	
4B --14	Foundation built with insulated concrete forms (ICF) or Insulated concrete "T" Mass or equivalent system with a minimum of R14	
4B --15	Insulated pre-cast concrete foundation system is used w/ min. R-10 Insulation.	

4B --24	Use steel studs to furr out new foundation walls for basement finishing.
4C --	New Exterior Walls Above Grade, All New Non-Slab (framed) Floors, All New Interior Partition Walls & All New Ceilings
4C --3a	Subfloor with no added urea-formaldehyde
4C --7	Insulated Concrete Forms (ICF) or Insulated Concrete "T" Mass walls are used for exterior above grade. (min.90%)
4C --9b	All-natural insulation, such as cotton batt, is used for at least 50% of applications. (Soy based foam insulation is not considered "all natural" and is not eligible for credit in this category)
4C --9c	Spray foam insulation applied in new studs
4C --9d	Spray applied wet cellulose insulation (proper drying required before installing wall finish and/or vapor barrier)
4C --10d	Air seal penetrations and joints in fireplace framing
4C --10g	Seal all gypsum or magnesium board penetrations in exterior walls using caulk, gaskets or appropriate connection with gypsum board
4C --10h	Seal drywall at top plate, bottom plate and penetrations with gasket, sealant or glue
4D --	New Windows, Skylights & Doors
4D --4	Install Energy Star light tubes to bring light to interior areas that receive limited daylight
4E --	New Attics & Roofs
4E --8b	All-natural insulation, such as cotton batt, is used for at least 50% of applications. (Soy based foam insulation is not considered "all natural" and is not eligible for credit in this category)
4E --8c	Spray foam insulation applied for air seal over entire attic floor. (R14 min.)
4E --8f	Add 1" min. foil face polyisocyanurate insulation to sloped roof / ceiling for thermal break and vapor barrier
4E --8g	Add 2" rigid insulation to interior of sloped roof / ceiling for thermal break and vapor barrier
5	MECHANICALS
5A --	Ventilation and Fresh Air for Occupants
5A --PR1	Design and install a whole-house ventilation system in accordance with SECTION N1104 MECHANICAL VENTILATION SYSTEMS of the (2007 proposed) Minnesota Residential Energy Code. If atmospherically vented appliances exist at the end of the project, home must pass a Worst Case Combustion Spillage test before occupancy.
5A--1a	range hood \leq 300 cfm
5A --1b	range hood > 300 cfm
5A --1c	ceiling exhaust fan or duct
5A --2a	1 Room
5A --2b	2 Rooms
5A --2c	3 Rooms
5A --2d	4 or more rooms
5A--4a	1 Room
5A--4b	2 Rooms
5A--4c	3 Rooms

5A--4d	4 or more rooms
5A--5	Install garage exhaust fan that is ENERGY STAR rated and runs continuously at min. 25 CFM. <u>OR</u> If it has intermittent operation, (i.e. controlled by a motion sensor or programmable timer), 100 CFM is required (attached garage only).
5A--8	Heat recovery ventilator (HRV) installed
5A--9	Energy recovery ventilator (ERV) installed
5A--10	All outdoor air intakes for ventilation located at least 10' away from air exhaust outlets and areas where vehicles may be idling.
5A--11	Install large media filter
5A--12a	Use HEPA or better-performing air filter with MERV rating of 12 to 15 (e.g. greater than 1" thick pleated filters preferred)
5A--12b	Use HEPA or better-performing air filter with MERV rating of 16 or higher (e.g. greater than 1" thick pleated filters preferred)
5A--13	Install UV light filter in return air duct and at the Air Conditioning "A" coil.
5B --	Moisture and Relative Humidity
5B --1	Install temperature and humidity sensors and record indoor/outdoor data for one year after project work. See attached "Temperature and Relative Humidity Tracking Table 5B -- 1"
5B --2	Installation of ENERGY STAR dehumidifier equipped with humidity sensor. (Portable, Stand-alone & HVAC integrated qualify)
5C --	HVAC DISTRIBUTION STRATEGIES
5C --3f	Ductwork sealed with water-based, low-VOC (<30 g/l) mastic or aerosol sealant
5C --4	Properly designed ductless HVAC system installed in home. Ducted bath fan, kitchen hood and make-up air allowed.
5C --5	Seal HVAC cabinet seams, and all seams of plenums and duct-work with mastic. Install gaskets on cabinet doors if possible.
5C --6	Rooms and zones have balanced air flow. +/- 3 pascals relative to the outdoors or adjacent rooms caused by any single or combination of fans or blowers.
5C --7	Inspect and clean air-handling equipment before installing diffusers, grilles, and before making system operational.
5D --	Heating and Cooling Equipment
5D --4	Install multiple zones in home to improve energy efficiency.
5D --5	Install hydronic in-floor heating system connected to heat source that has at least 80% AFUE boiler. Connecting to ground source heat pump or hot water solar systems also qualify.
5D --9	House does not have A/C system and designed to provide passive cooling.
5E --	Miscellaneous Mechanical
5E --1	Do not install a decorative fireplace or stove of any kind
5E --2	Install a central vac system that is vented to the exterior
6	ELECTRICAL
6A --	Appliances
6A--4	Install gas cook top
6A--5	Install induction cook top
6B --	Fans, Fixtures and Lights

6C --	Wiring
6C--1	Direct wire all bath fans to light switch or humidistat
6C--3	Ground electrical panel to a dedicated ground stake (not rebar, plumbing pipes or any integral part of the house)
6C--4	All electrical wiring run in metal conduit
6C--5	Run wiring in bedrooms in metal conduit
6C--6	Keep electrical service connection, electric meters, and panels at least ten feet from sleeping areas
6D--	Electrical Systems
6D--3	Ground electrical panel to approved dedicated "Hammered-in" ground stake (not rebar, plumbing pipes, or any integral part of the house)
6D--4a	All wiring within 6' of a bed is run in metal conduit (flexible and rigid qualify)
6D--4b	All electrical wiring in whole house run in metal conduit (flexible and rigid qualify)
7	WATER - PLUMBING, SYSTEMS AND FIXTURES
7A --	Equipment
7A--1a	Install a sealed combustion unit
7B--	Fixtures
7B--1	Install NSF certified water filters on drinking water sources
7B--2	Install NSF certified whole house water filter
7B--3	Install an NSF certified reverse osmosis filter on all drinking water source
7B--8	Install chlorine filters on shower heads or whole house chlorine filter
7B--9	Seal around tub and shower traps in basement or other "slab set" drain locations using a plastic box as a form
7C--	Piping
7C--1	Run new water lines in copper alternative (PEX)
7D--	Water Systems
7D--2	Install whole house sprinkler system
7D--6	Use PVC alternative for drains and vents
7D--7	Install sump pump cover that is air tight & mechanically attached with full gasket seal.
8	FINISH MATERIALS AND COATINGS
8A --	Wall Coverings and Ceiling Materials
8A--1	Install plaster and lathe on walls and/or ceilings
8A--2a	No VOC primer
8A--2b	Very low VOC primer
8A--2c	low VOC primer
8A--2d	No VOC paint
8A--2e	Very low VOC paint
8A--2f	Low VOC paint
8A--3a	No VOC primer
8A--3b	Very low VOC primer
8A--3c	low VOC primer
8A--3d	No VOC paint
8A--3e	Very low VOC paint

8A--3f	Low VOC paint
8A--4	Install tile, glass or stone for all shower or tub surrounds
8A--5d	Low emitting or no-added-formaldehyde
8B--	Flooring
8B--1	No wall-to-wall carpet in bathrooms, kitchens, entryways and utility rooms
8B--2	Install all hard-surface flooring (no carpet)
8B--3	Install tile, glass, or stone for all shower flooring
8B--4	Install sealed concrete floor (min. 80% of interior finish slab-work)
8B--5	Underlayment contains no added urea-formaldehyde
8B--6	Use low VOC carpet glue
8C --	Millwork and Doors
8C--1d	Low emitting or no-added-formaldehyde (NAF) (see requirements)
8C--2d	Low emitting or no-added-formaldehyde (NAF) (see requirements)
8C--4d	Low emitting or no-added-formaldehyde (NAF) (see requirements)
8C--5d	Low emitting or no-added-formaldehyde (NAF) (see requirements)
8D --	Countertops
8D --1d	Low emitting or no-added-formaldehyde (NAF) (see requirements)
8D --2d	Low emitting or no-added-formaldehyde (NAF) (see requirements)
8D --4	Wood substrate for countertop has no-added urea formaldehyde
8E--	Cabinetry
8E--1c	Low emitting or no-added-formaldehyde (NAF) (see requirements)
8F--	Coatings and Adhesives
8F--1	Supply workers with VOC protection
8F--2	Adhesives are urea-formaldehyde free
8F--3	Caulks are low VOC (minimum 75% caulk applications)
9	WASTE MANAGEMENT
9A --	Construction Waste
9A--8	Building materials stored on site are protected from weather exposure. Materials wetted during the construction process are allowed to dry before enclosing in building assembly.
10	EDUCATION
10A --	Homeowner and Subcontractor Education
10A --1	Expand homeowner's user manual
10A--2	Provide owners of home with two radon test kits designed for 48-hour exposures, including instructions for future use and guidance for follow-up actions to testing results
10A--3	Homeowner given a walk through education during framing to explain design and construction of their home.

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