



Highlands Biological Station
Western Carolina University
Field Station Review
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Office of Institutional Planning and Effectiveness

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Executive Summary

In August 2015, Western Carolina University initiated an external administrative review of the Highlands Biological Station. The review team was composed of two internal reviewers and two external reviewers. **The purpose** of the review was to identify strengths, weaknesses, opportunities, and threats for the facility and its programs. During the three-day site visit, the review team made use of prepared written material, in person on-campus and field station interviews, teleconference meetings, and email correspondence with administration, staff, station users, and other stakeholders. **Analysis of programs** generated recommendations for building on strong instructional and research program integration, recruitment and support of early career research scientists, improving instructional faculty compensation, further developing semester-based student programs, and increasing commitment to outreach initiatives. **Analysis of staff and administration** focused on improving maintenance support, increasing institutional responsibility for program-critical staff positions, improving within field station, and field station-to-Western Carolina University campus communication, and involving staff in development initiatives. **A budget review** brought to light a need to increase “user days” thereby increasing receipts for housing and lab use fees, and a need to cultivate campus support in development activities. **The state of facilities** is very good. Information technology support from campus would add significant value to research and teaching programs. A backup power system is required for the field station to reasonably support modern scientific activities. Housing and other residential space improvements and/or additions are a critical need and vital to the field station’s continued success and viability. Researchers need protected and controlled field plots where manipulations and long-term studies can be established. **Future planning and growth** of the facility are areas of strength, but will depend on better integration and cooperation between the field station and independent foundation. Existing planning initiatives are a valuable asset. **In summary**, the review team found the Highlands Biological Station in excellent condition. In general, Highlands Biological Station reflects both the mission and goals of Western Carolina University and the University of North Carolina system, both admirably and effectively. The facility and its programs are widely regarded as a “bright light” in the UNC system, deserving of high priority in resource allocation decisions. Highlands Biological Station’s greatest assets are its location, rich biological resources, long history and tradition of place-based research, tightly integrated research and teaching programs, coalition of supporting member institutions, committed researcher base, and its local and foundation support.

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I. Introduction

The purpose of this external review is to identify strengths, weaknesses, and recommended changes for the programs, administrative structure, and facilities of Highlands Biological Station (HBS). The team was composed of two internal reviewers (Kloeppel and Ferguson) and two external reviewers (Nagy and Oktay). The review draws from, references, and is designed to complement the comprehensive *HBS Academic Program Review Response to Standards June 2015* and its appendices (“Self Study” J.T. Costa).

The review team was supplied with the Self Study, the WCU 20/20 Vision Plan, reviewer instructions, other background material, and Highlands Biological Station and Western Carolina University informational web links in advance of the site visit. The review team met starting Sunday evening 23 August 2015, and ending midafternoon Tuesday, 25 August 2015. The visit was composed of numerous meetings with field station stakeholders of all types - from top level university administrators, to HBS staff, Highlands Biological Foundation representatives, faculty conducting research, and undergraduate students taking classes at the station. Refer to the Appendix for the complete site visit schedule and meeting attendee lists. All meetings were held as scheduled (in person on the WCU campus, at HBS, or by teleconference) with the exception of a minor reorganization of exit summary and report meetings. The HBS Associate Director was unavailable to meet personally during the visit, but was contacted immediately afterward and provided written responses to questions. The committee was charged with presenting a summary verbal report before departing from the site visit and with preparing this written review document.

Western Carolina University (WCU) and the University of North Carolina system have clearly defined goals and missions. The review team formed evaluations and recommendations in light of the field station’s parent and consortium institutions’ priorities and values. Specifically, and following WCU review handbook guidelines, the team 1) focused on ways the field station could maintain high-quality programs and services that are competitive and consistent with the University’s mission, 2) supplied feedback highlighting strengths of programs, identified opportunities for strategic change, 3) discussed the unit’s ability to meet the changing needs of stakeholders and identified areas for improvements, and 4) provided data and context necessary for planning changes in allocation of resources. Throughout the report the team summarized HBS’s effectiveness in comparison to similar facilities nationwide. In each section the team identified strengths, weaknesses, opportunities / next steps, and threats. In many cases opportunities/next steps mirror specific recommendations discussed in more detail in the preceding text section. It was the review team’s goal to provide constructive criticism and suggestions for improving facility function, growth, and better support of parent institution mission.

II. Analysis of Programs

The Highlands Biological Station (HBS) has a variety of programming initiatives that have grown and changed since the station's inception in 1927. As an organization, it has continued to develop ways to best meet the needs of its constituents and to fulfill its mission "to foster education and research focused on the rich natural heritage of the Highlands Plateau, while preserving and celebrating the integrity of the biological crown of the southern Appalachian Mountains" (<http://highlandsbiological.org/> downloaded 13 October 2015)

The programming summary is divided into three sections including Research, Education, and Outreach. While the committee was not interested in reviewing the plethora of activities and initiatives contained in the HBS Self Study, we will focus on some of the highlights and challenges in each section as well as on material and conversations we gathered during the site visit.

Research Programs

The research portfolio at HBS is varied, but is most famous for its long-standing and highly-cited body of knowledge concerning plethodontids and other groups of salamanders. The southern Appalachians are perhaps the planet's richest "hot spot" of salamander diversity. This high diversity, and density, of salamanders on the Highlands Plateau has led to decades of observations, experiments, undergraduate and graduate research projects, and scientist careers centered on salamanders. Directors at other field stations admire the focus that the study of salamanders brings to HBS and the long-term reputation that HBS researchers have for their depth of knowledge on the subject. But a very narrow research mission is not optimal for any field station. And HBS's research program has diversified over the past 15 years to include scientists and students in other fields of biology and ecology that have strengthened the research portfolio at HBS. Building on this diversification, and attracting new researchers, is crucial for the long term success and growth of HBS.

Fortunately the research conducted at HBS is strong. In the past 15 years HBS has generated 177 scientific publications, reports, and books – averaging approximately 12 per year. In addition, 38 theses and dissertations have resulted from research at the field station in the same period – 2 or 3 per year. These numbers are respectable for any field station, and excellent for one of this intermediate size. In the tracking year ending in 2015, HBS hosted research groups from eight outside (non-WCU) institutions, five of them from outside North Carolina. Total user days (including all programs) totaled 4,212 – an average of over eleven persons per day. For a primarily seasonal field station these are excellent numbers. Figures here (and below) are from *HBS Academic Program Review Response to Standards, June 2015* (the "Self Study").

It is worth noting the strong connection between the research and education programs at HBS. Researchers, instructors, and program directors at the field station have long valued the connection between research and education as a vehicle for advancing both missions. This has been very successful at HBS. Many research efforts involve students, and most students are

involved in some research program. This tight linkage between the programs is perhaps Highlands Biological Station's greatest asset, and is a model that departments and field stations across the nation are working to develop themselves. **RECOMMENDATION:** The committee praises this accomplishment and urges UNC and WCU to continue to support and promote this relationship by developing teaching programs that occupy more of the academic year (as the fall Institute of the Environment program does now) and by recruiting top-flight instructors willing to immerse students in research, and thereby establish research programs at HBS.

A concern that the review team had is whether there is an enough ongoing research effort, and support, to recruit early career scientists to the HBS research population. The review team noted the relatively late career stage of most of scientists on site. A more demographically diverse research population (age/stage, gender, heritage, background) is hugely beneficial in growing research and education programs. **RECOMMENDATION:** It is worth considering expanding the Grants-in-Aid program both in size and scope in an effort to build and diversify the researcher population. There was also concern that education and outreach programs may saturate facilities and housing at HBS such that these resources may not be available for researchers. Researchers need places to live and work when the field season demands it. **RECOMMENDATION:** Proactively contact Principal Investigators early in the year to schedule housing and resource needs for the upcoming season and/or block out housing for researchers during times that demand is likely to be high

Instructional Programs

The summer courses and the fall semester Institute of the Environment program are the highlights of the educational programming at HBS. The summer courses have maintained or increased enrollment at HBS while summer courses at field stations across the country have been in a destabilizing or declining mode. The variety of field courses, the pattern of offerings (annual or biannual), excellent instructors, and great teaching facilities have enabled HBS to maintain and grow a summer course program. Easy access to field sites, minimal time lost to long-distance travel, and on-site housing options provide an immersion experience that is impossible to match in traditional campus lecture and lab courses. There was concern that compensation to summer course instructors is very low and not competitive. This places the summer teaching program in jeopardy. **RECOMMENDATION:** Summer instructors should be compensated based on academic year WCU pay scale. Otherwise, HBS risks losing quality teaching faculty and its high quality summer course program.

The fall semester Institute of the Environment course is a long-standing model developed by former HBS Director Robert Wyatt and leaders at the UNC-Chapel Hill Institute for the Environment. Director Jim Costa and Associate Director Karen Kandl have elevated this association and provide a top-notch semester field and lecture experience for up to 12 students each fall. While most students are from UNC-Chapel Hill, other participants are from Western Carolina University, UNC-Asheville, and North Carolina State University. Many of the participating students

go on to graduate school. The research and writing experience they gain in the Institute of the Environment fall program at HBS is a great graduate school preparatory tool.

In the 2014-15 year, HBS offered 15 summer courses serving a total of 132 students. This is a remarkable number of offerings, and number of students, for a biological field station of HBS's size and budget. **RECOMMENDATION:** The committee suggests HBS is ripe to experiment with some kind of "honors college immersion experience" - perhaps an elective experience for 12 or so students drawn from incoming freshmen so that they will be able to further develop their relationship with HBS over the course of their undergraduate careers.

Outreach Programs

There is widespread support for, and impact from, the outreach program at HBS. Thousands of children and adults visit the Nature Center annually and thousands more school children benefit from the school lectures, demonstrations, and visits by the school outreach program. This diversity in content delivery, as well as its high visibility, increases public support for HBS.

Outreach is a major part of HBS's mission and activity. The Nature Center served 24,073 visitors and ran 249 programs in 2014. The school outreach program reached 3,388 people in 121 separate school programs. The committee cannot say enough about the value of a vibrant and successful outreach program. It is what justifies federal and state dollars spent on research to the taxpayers, and does the job of translating science for public consumption. The Highlands Biological Foundation is a shining illustration of the value of a successful outreach program. HBF has supported and nurtured HBS's outreach. It is critical that the UNC system and WCU also recognize and value a strong, and growing, outreach program at HBS. The outreach programs at HBS (School Outreach, Nature Center, and Botanical Garden) are models for sister field stations around the country. **RECOMMENDATION:** Commit to permanent staff support for all three legs (School Outreach, Nature Center, and Botanical Garden,) of the outreach effort at HBS.

Strengths:

- Outreach programs.
- Summer course program.
- Institute for the Environment program.
- Student connection to research.
- Research tradition and history.
- Research program connection to the education program (redundant with above, but value is in both directions).
- Grants-in-Aid program.

Weaknesses:

- Outreach staff position permanence and compensation.
- Summer faculty compensation.
- Breadth of research areas.
- Aging demographic of principal investigators.

- Researcher housing capacity limitations.

Opportunities / Next Steps:

- Continue to build top-notch and diverse outreach program with UNC and HBF support.
- Commit to competitive compensation or summer teaching faculty.
- Expand Grants-in-Aid program as a way of recruiting new career researchers (faculty and post-docs).
- Recruit a diverse researcher base using expanded Grants-in-Aid program – human diversity as well as research area diversity are critical.
- Identify 1 to 2 new research area targets (e.g. “climate change,” “biodiversity,” “molecular bioinformatics,” etc.).
- Researcher housing constraints can be addressed with changes to housing facilities or careful allocation of housing resources.
- Using the Institute of the Environment program, expand programs and support further into the shoulder season (e.g. “honors college” effort, or a spring semester program).
- Continue reaching out to a variety of non-biology departments at WCU.
- Expand outreach program to include citizen science projects.

Threats:

- Aging principal investigator population.
- Loss of valuable outreach staff.
- Loss of valuable summer course instructors.
- Relatively narrow research focus.

III. Analysis of Staff and Administration

The HBS Executive Director reports to the Board of Directors (composed of institutional representatives from both inside and outside the UNC system), to the Office of the Vice President for Research at UNC General Administration, and to the Office of the Provost at WCU. The Board operates under bylaws, advises the Executive Director, and performs various functions in support of HBS programs and scientific focus. WCU and UNC General Administration determine field station operating budget, with contributions by the Highlands Biological Foundation (an independent organization designed to support HBS mission and programs with development funds).

The field station executive function is administered by an Executive Director and Associate Director. Support staff is composed of eight full and part time positions, one of whom is dedicated to the Foundation: office/business manager, two program assistants, outreach educator, Nature Center educator, facilities manager, horticulturalist, and HB Foundation director. Two full time summer interns also support the Botanical Garden and the Nature Center. Funding for positions is shared among North Carolina state funds, the HB Foundation, and other sources. Only the Executive Director, office/business manager, and facilities manager hold 100% state funding lines.

The review committee was impressed by the quality of the staff members, their skill, level of sophistication foresight in executing their duties, and their intellectual and creative contribution to

the field station at large. The staff exhibited dedication and strong commitment to the field station, its mission and goals, and its reputation in the local and scientific communities. Staff members clearly work well together and appreciate the professional community cultivated at the station. Degrees, credentials, and skills held by staff members is impressive and a credit to their positions. Staff is evaluated annually by the Executive Director and Associate Director. The division of duties, responsibilities, and staffing level seems to fit the suite of programmatic and facilities needs well, with the exception of facilities maintenance, and caveats below regarding position stability and funding.

The committee wishes to make special note of the exceptional contributions to the biological station by the current Director, Jim Costa. He is clearly responsible for significant improvement and revitalization of programs and facilities in his tenure. Instructional programs and especially outreach have all improved and continue to be exceptionally strong for a station of this size. Facilities and staffing are also exceptional, with a few facilities concerns noted elsewhere. The wisdom, skill, and expert guidance of the Director are clearly responsible for the station's current strength and productivity. The internal report prepared by the Director for this review is excellent and was invaluable to the committee. The Director also appears to have the full confidence of his staff, station users, and the HB Foundation.

It is clear that the maintenance supervisor is extremely skilled and capable. But for a facility the size of HBS a single maintenance staff person is inadequate. While major projects may get accomplished because they are high priority, highly visible, and can justify outside contractors, the price will be a decline in basic upkeep, lack of preventative maintenance and excess time spent to address small relentless issues. The committee sees two obvious solutions. **RECOMMENDATION:** 1) Engage WCU campus facilities support for medium size projects that can be easily accomplished by a small team in a few days, but will free up many days of effort for the HBS maintenance supervisor, and 2) hire a part-time assistant for HBS maintenance supervisor.

The structure of funding sources (as illustrated in Appendix 12 of the Self Study) for various staff positions appears to be the result of historical opportunity rather than planned allocations reflecting importance to field station mission and logical responsibility. The committee recommends that duties that are mission critical to the field station function and program support be fully funded by university state funds. Relying on unstable soft money serves to destabilize positions and impacts incumbent's commitment and security, and ultimately tenure. Most notable here is the Associate Director position, currently funded 50% by state funds and 50% from "other" soft grant support. **RECOMMENDATION:** UNC Administration and WCU should be 100% committed to supporting this permanent position at one FTE (faculty or lecturer level). WCU or UNC system institutional support should also be bolstered for the outreach educator and Nature Center positions. As stressed elsewhere in this report, the outreach mission of HBS is critical to the survival, reputation, and ability to fund raise of the field station. Few peer field stations in the U.S. have outreach programs as successful or prominent as HBS. Outreach programs are increasingly valued at field stations. HBS is very visible to, and very much a model for, other peer biological field station. It is in large part the outreach programs at HBS that put it so closely in line with the mission and goals of WCU and the larger UNC system. These two reasons alone argue for increased institutional support for the anchor outreach positions. **RECOMMENDATION:** Given the interests and mission of the HB Foundation we recommend aligning the outreach and Nature Center

positions to match the horticulturalist position, i.e. 50% state and 50% Foundation.

RECOMMENDATION: We also suggest one of the program assistant positions be upgraded to permanent and full time “specialist” level and made 100% state funded (only a 10% change). Funding for the Executive Director, business/office manager, facilities manager, horticulturalist, one program assistant, Foundation Director, and summer interns appear to be well structured.

Overall, the committee feels there is real and current risk of high-value staff attrition due to funding level and insecurity. **RECOMMENDATION:** Make sure evaluations and raises show parity with parallel on-campus positions. Identify positions that are in need of parity raises.

The staff reports a need for better internal communication. **RECOMMENDATION:** This is easily satisfied by instituting formal weekly staff meetings. Staff members also feel somewhat isolated from colleagues on the WCU campus. Efforts to connect field station and campus offices can be hugely helpful and supportive to small, overloaded, multitasking remote offices. Identifying mid-to-upper level administrative offices (dean’s office, library system, Human Resources, accounting, IT, GIS, research computing support, facilities, biology department) that may be able to partner with HBS staff in accomplishing tasks or satisfying common mission goals will both support field station staff and reduce redundancy in effort for both field station staff and WCU. It is often the case that field station staff can assist campus staff in addition to the more obvious assistance from the main campus. **RECOMMENDATION:** Work, from both sides, to establish lines of communication between field station and campus offices. This can be as simple as putting two people in touch, or as formal as organizing quarterly field trips between Highlands and Cullowhee.

The need for a staff person tasked with discovering and pursuing external grant support was raised by the staff. This would be a luxury at a small field station. **RECOMMENDATION:** The Office of Research Administration at WCU is staffed to handle this and is open to supporting the directors and staff with pursuing external funding by way of grants and contracts. One of the program specialists, or assistants could take on this duty, in collaboration with the Executive Director or Associate Director.

Salary for summer teaching faculty is below comparable on-campus positions. This condition puts the entire teaching program of the biological station at risk. The teaching, and research, programs of the facility are completely reliant on high numbers of high quality teaching faculty. The challenge of recruiting such temporary and transient employees is great. Summer demands on faculty is an increasing national trend and fair compensation is increasingly critical to recruiting high quality instructors. **RECOMMENDATION:** Commit to regular WCU faculty wage levels for summer instructors based on rank and “at-home” pay grade.

Strengths:

- Director James T. Costa.
- Staff is extremely competent, motivated, and dedicated.
- WCU administrative and resource support.
- Highlands Biological Foundation provides outreach and excellent financial support.
- Facility evaluation and improvement efforts are documented.
- Office processes are well structured.

Weaknesses:

- Small size of maintenance staff.
- Staff pay is low in some cases - pay parity issues.
- Unstable funding sources for some staff.
- Unbalanced university commitment to mission-critical staff.
- Staff communication, both within HBS and between HBS and WCU campus.
- It is not obvious if staff is engaged in procuring external funds.
- Low pay for summer faculty instructors.

Opportunities / Next Steps:

- Connect HBS and WCU staff (campus visits, formal or informal, quarterly per year).
- More use of WCU campus services and support (Library, IT, Research support software).
- Make use of WCU campus facilities maintenance support for medium size projects, or, hire a part-time assistant for HBS maintenance supervisor.
- Fund mission critical staff functions and programs with state lines.
- Address staff pay parity issues.
- Institute weekly staff meetings.
- Engage a staff member in external fund exploration with the WCU Office of Research Administration.

Threats:

- Losing good staff members.
- Facilities deterioration and safety/liability issues.

IV. Analysis of Budget

The Highlands Biological Station has a diverse set of funding sources to support staff, facilities, and programming. This review summary attempts to detail the range of sources and also notes some of the strengths, weaknesses, opportunities, and threats of the current funding model.

The attached summary highlights the following funding sources for the 2014-2015 Financial Year:

1) North Carolina State funding total \$371,904

a. State allocation: \$268,000

b. Highlands Biological Station receipts: \$102,904

This source of funding includes fees from courses, workshop and housing fees from summer students, and housing fees from visiting classes and researchers. This annual revenue target was \$60,000 in 2010-2011 and is now targeted for over \$120,000 in the 2015-2016 fiscal year.

c. The usage of this increase in the funding is for programming assistants and much needed building repairs.

- 2) Grassroots Science Museums Grant funding total: \$62,887
 - a. The usage of this funding is the salary for the position that runs the School Outreach Program, one summer intern, and some of the expenses to run the Nature Center.
- 3) Highlands Biological Foundation: \$108,000
 - a. The usage of this funding is for Grants-in-Aid stipends \$25,000, salaries \$65,000 (for Nature Center Educator, 50% of the Horticulturist's salary, and part-time office assistant staff position salary and benefits), financial aid \$4,000, instructor stipend \$3,500, and miscellaneous \$10,500 (educational supplies and \$500 for food for board meetings and events).
- 4) Institute for the Environment: \$50,616
 - a. The usage of this funding is for partial salaries for the two coordinators (Executive Director and Associate Director) and a small amount for the programming assistant.
- 5) Total 2014-2015 Annual Budget: \$593,604

Please find below the summary highlights of the State and Federal Grant Appendix:

- 1) State Grant Funding Totals 2005-2013: \$1,615,783
 - a. These funds exclusively paid for facility and equipment repairs and improvements including buildings, vehicles, utilities, smoke and fire alarm systems, and lab equipment.
- 2) State Grants Grassroots Science Museums Collaborative 2005-2015: \$725,397
 - a. These funds ranged from \$62,816 to \$79,268 per year and exclusively fund staff, programs, and operations of the Outreach Program and Nature Center. Number 2 in the 2014-2015 summary above is part of this funded category.
- 3) Federal Grants from the National Science Foundation Field Stations and Marine Labs program and the National Oceanic and Atmospheric Administration: \$586,159
 - a. Three grants (two NSF and one NOAA) provided funds for major building renovations at Highlands Biological Station in 2007-2008 NSF, 2011-2012 NOAA, and 2012-2013 NSF.
- 4) Other Grants
 - a. A series of 15 other grants ranging in value from \$3,900 to \$175,000 funded repairs, energy efficiency conversions, programming support, and furnishings.

Strengths

- Multiple funding sources provide some flexibility and durability in the event of funding allocation changes.
- All the supporting organizations including the HB Foundation and the current Director are creative and use a diverse portfolio of funding tools in their efforts to financially support the station.

Weaknesses:

- The funding sources have been difficult to increase with the exception of the Highlands Biological Station receipts. The station staff has worked hard to more efficiently collect and increase receipt funds as a result of higher class enrollment and higher housing usage and housing rates.

Opportunities / Next Steps:

- If Highlands Biological Station is able to increase housing capacity, they have the potential to increase housing receipts and foster additional research collaboration during the busiest summer season.
- Enlisting help from the WCU Office of Research Administration to obtain external grants (e.g. for interdisciplinary programs or users) could bolster finances.

Threats

- Major funding cuts from the State of North Carolina or in any of the funding sources due to dynamic economic conditions or changes in leadership could easily eliminate programming assistants, salaried positions, and operating and repair funding.
- Medium size “deferred maintenance” (\$10K-\$30K) or facilities upgrade work may be hard to fund without periodic institutional commitment.

V. Analysis of Operational Facilities

The facilities at HBS were reviewed through a guided walking tour, interviews with station staff and users, and the Self Study document prepared by the Director. The guided tour exposed the reviewers to all HBS station buildings, the Nature Center, and the Botanical Garden. Overall, the on-site facilities and grounds appeared to be in good-to-excellent condition, well maintained, and adequately supplied with associated equipment and furnishings. Only the condition of two housing facilities and one common facility showed the potential to limit the station’s ability to increase programming opportunities for both students and faculty.

Several newly renovated work spaces and laboratories (Coker and Bruce) were observed by the review team. They included the research/learning laboratories, teaching spaces, meeting rooms, library, herbarium, and administrative offices. Resources for these renovations were provided through the State of North Carolina, the National Science Foundation, and the HB Foundation. These facilities were observed to be high quality and a strong component in support of the mission of HBS. Associated laboratory equipment, computer technology, and other learning support technologies provide an adequate level of support to the constituencies. The Nature Center is well designed, seems to function well and is full of displays and facilities skillfully crafted to fulfil its purpose. The need for increased animal display facilities was noted.

The infrastructure of the other buildings is adequate in meeting the mission of HBS. Potential future issues with information technology and the power system were noted. Keeping current with IT services and software support and availability is a universal issue for field stations.

RECOMMENDATION: Engage WCU’s IT services about the use of a Virtual Desktop system and/or

the potential for improved IT support as well as research support software and related services. Several constituents revealed the lack of backup power generation in the event of a power outage. The loss of electrical power for more than 30-60 minutes can result in the loss of irreplaceable samples stored in refrigerators and -20C and -80C freezers. Researchers (especially those employing molecular techniques) may be hesitant to use field station facilities that do not have power backup systems. **RECOMMENDATION:** Review all power-critical systems and install central backup power generators. As an immediate and short term solution, several low-cost portable generators can be used to satisfy most critical needs.

Housing, as related to the expansion of programming, consistently led the discussions with faculty, staff, and constituents throughout our review period. Several constituents expressed the need for more efficient housing, especially in peak periods of habitation during the summer field session. It was evident that HBS has made efforts to seek additional funding to build a new dormitory facility. The review team agrees that housing is the primary constraint to the expansion of programming at HBS.

The reviewers toured five dorm/cottage structures. Duplex 1 and 2 (4 beds each, 8 total) were pleasantly appointed, one being ADA compliant, and suitable for use by faculty, staff, or students. The Valentine House (12 beds) was praised by the current occupants (students) for its character, communal living environment, and sleeping arrangements. However, concern was expressed over the flexibility and capacity of student gear/clothing storage, especially when at full occupancy. The Howell Cottage (6 beds) was observed to be relatively updated, nicely appointed, and adequate for general housing use. The Wright and Deacon Cottages (12 beds, 4 bedrooms) are one story block buildings with shared bath facilities. These two cottages were observed to be in most need of renovating or replacing. **RECOMMENDATION:** updates to Valentine and Howell to increase both the capacity and efficiency of the living conditions. **RECOMMENDATION:** renovations and additions to, or replacement of, the Wright and Deacon cottages including expansion of the number of bedrooms and bath facilities to increase both the capacity, efficiency, and attractiveness of the living quarters. The addition of an energy efficient automated environmental control system, to reduce humidity levels in the summer months, additional windows, insulation, and wallboard, will further improve these living spaces. While various ongoing planning efforts exist to relocate housing from the station center, the committee suggests that central housing, especially of students, contributes to a very positive social and learning atmosphere and connection to the place and the science. Living and learning communities increasingly dominate university science approaches to both attracting and retaining their best students. Quite a number of creative and alternative housing concepts were discussed during the site visit. These included a Cherokee long-house, group camp area, tiny house E-design challenge, and/or yurts located in available building sites on the grounds of HBS. All are worth entertaining and exploring. Alternative or unique housing facilities are a great way to foster creativity at a field station and generate comradery, bonding, and station support among users. Note that HBS was approved for a \$3.5 million in funding for a replacement residence facility in the 6-year Capital Improvement plan approved by UNC-GA and WCU. This funding was identified for FY 2015-16, but remains unfunded. **RECOMMENDATION:** The committee saw a strong need for improved housing quantity and

quality. This could come in the form of significant renovation of existing square footage, modest addition of square footage, or major addition or replacement of some housing facilities.

The reviewers also noted the expressed need and current efforts to seek funding for a communal gathering facility to facilitate both social and collegial interactions. The review team toured the Weyman facility and found that while it provided basic cooking and laundry facilities for participants, it was in need of refurbishment and updating if future use includes communal space.

RECOMMENDATION: Reworking of this space could include a central communal area with appropriate furnishings. Additional communal space could be created at a cost-savings with the addition of an attached open-air covered pavilion. There is also the potential in Weyman for increased housing.

The station staff members who participated in the on-site interviews were insightful and passionate about their work. Their knowledge of the relationship between the station's facilities, their work/service function, and the mission of HBS were evident and helpful to the review team. While maintenance of facilities and the Botanical Garden were a past concern of HBS, due to the death of a long-term maintenance employee and absence of a horticulturalist, the current staff is commended by the review team for its dedication to mitigating a large amount of past maintenance needs in a short amount of time. The planning and execution of preventative maintenance measures by the staff was further praised by the reviewers. As mentioned in the Staff and Administration section of this report, responsibilities and work load are too large for a one-person maintenance department. **RECOMMENDATION:** The committee warns prioritization of critical issues may result in deferring of medium to long-term needs. Replacement and upgrade needs in the 5-10 year time frame will accumulate without support from an on-site assistant, or regular engagement by WCU campus facilities maintenance department.

While not strictly "facilities," the lack of station owned or controlled plots or study areas where researchers or students can conduct manipulative experiments is a serious weakness for a biological station. Researchers are forced to go off-site and to forge agreements with private land owners or the Forest Service (with the support of HBS) to gain access to needed research areas. This is a hardship and could discourage potential researchers. **RECOMMENDATION:** Acquisition of near-by property suitable for manipulative research activities would be a huge asset for HBS. Alternatively, long-term lease or use agreement with state or federal agency, NGO, or private land owner would also solve this problem.

It is also important that the HBS and HB Foundation visions for priority infrastructure improvements come into alignment. The institutions are natural allies. Divergent visions for high priority grounds or building projects will slow improvements and hamper the mission of both.

Strengths:

- Excellent new scientific and educational facilities (renovations and equipment).
- Location of facility in biologically rich area and convenient to local community.
- Nature Center.
- Botanical Gardens.

- Attractive and compact site.
- Ability to attract multiple funding sources for facilities projects.

Weaknesses:

- Inadequate / undesirable housing.
- Insufficient housing at peak use times.
- Lack of obvious core social / gathering area.
- Lack of power backup system.
- Incomplete IT support from WCU campus.
- Maintenance team size.
- Small site does not permit for flexible research manipulation plots for researchers and classes.

Opportunities / Next Steps:

- Additional animal display facilities in Nature Center.
- Renovation of existing housing may satisfy needs without new construction.
- New / updated housing construction may be most desirable and in fact has been approved, but as yet unfunded.
- Reallocation of poorly used space to housing could add beds.
- Existing space could be repurposed to social / gathering area, e.g. common dining space.
- Consider the site of old Ilges cottage as new housing location.
- Install power backup system – either integrated single automated system, or set of temporary portable generators for most critical needs.
- Add maintenance assistant or engage WCU campus maintenance department for medium and large scale projects; Director can maintain a prioritized project list.
- Acquire natural research area suitable for manipulative research projects.
- Align HBS and HB Foundation facilities priorities and visions.

Threats:

- Loss of critical research material and potentially entire research projects in the event of prolonged power failure.
- Loss of users due to inadequate housing.
- Facilities deterioration.
- Perpetual limit to researcher use due to lack of long-term protected research plot access.

VI. Analysis of Planning and Development

Planning and development is closely aligned with both the programming needs and budgeting resources for HBS. The Director is doing an exceptional job of tapping a variety of community and conservation sources in addition to National Science Foundation funds to provide programming support and capital improvement monies. The HB Foundation has been extremely generous and is responsive to staffing needs. They have filled the gaps that have enabled the outreach program to be successful. The HBF has a volunteer board which includes scientists and other stakeholders. It

has been involved for many years with the HBS. There is some misalignment between the HB Foundation funding priorities and the priorities identified by the HBS station administration.

RECOMMENDATION: Better communication and justification for the research and outreach needs between both parties would facilitate that alignment. The committee also recommends a formalized and regular process for updating station planning.

The HBS Director has created a strategic plan which has been carried out relatively methodically. That plan should be reviewed and revamped regularly as per the above recommendation. The Director excels at applying for grants and looking for opportunities from a variety of funding sources. The HB Foundation, the Nature Center, and the Botanical Garden's advocates and staff are adept at diversifying the support base while also engaging the public.

The intricacies of the multiple entities overseeing the field station (WCU, UNC system, HB Foundation, and the HBS Board of Directors) and their individual interests are both an asset and a challenge. It is inevitable that conflict will exist around development and planning. For instance, a long term management plan for the Botanical Garden may not intersect with the needs of the research and educational users. It is important to have a strong and recognized Director who can engage the multiple parties and negotiate solutions that best fit the HBS mission. It is equally important to survey all users and review prior planning efforts to ensure that new buildings help HBS to grow efficiently while allowing current access to the public sections of the campus.

Special attention is due here to recent and important planning efforts. According to the HBS *Academic Program Review Response to Standards* (the "Self Study") prepared by J.T. Costa, "The current strategic goals/objectives of HBS focus on facilities and programming, with the aim of doubling the academic programs and increasing residential occupancy from 38 beds to 50 beds over 2006 levels." A master site planning process identifies a new 30-bed residence facility as their greatest need. It is anticipated that additional revenues generated by expanded housing facilities will offset operational costs. As mentioned elsewhere, improving and/or increasing housing is critical to the mission of the facility. **RECOMMENDATION:** Adhere to goals outlined in the Master Site Planning and "Self Study" while maintaining flexibility to solve housing challenge in most logical and efficient manner (some options outlined in this report).

Strengths:

- HBS mission and goals are well aligned with the mission and goals of WCU
- Active and clear communication with WCU main campus
- Foundation and community support, both intellectually and financially
- HB Foundation members include prior and current field station scientists and other users
- Board of Directors is engaged
- Strong master plan and action items
- Revised 2013 Master Site Plan
- Capital campaign feasibility study underway
- Botanical Garden planning process
- Complex and multi-parted administrative and funding structure

- Architect has provided low/no cost plans which can be used for fundraising and planning purposes

Weaknesses:

- Local physical visibility and brand recognition (signs and logo inconsistent with WCU and UNC System)
- Community's understanding of "research potential" is limited
- Citizen science opportunities underutilized
- Nature Center inclusion of current research (not maximized)
- Effort and vision alignment between HBS and HB Foundation
- Complex and multipart administrative and funding structure
- Housing needs identified but some options not fully evaluated

Opportunities / Next Steps:

- Branding improvement (careful thought to research, education, outreach emphasis)
- Better signage at roadside
- Increased use of newspaper articles, radio, and TV
- Formalized and regular process for conducting station planning and for creating a whole-site concept plan.
- Pursue existing Master Plan goals.
- Pursue alternative housing problem solutions. E.g. Calculate number of beds needed; map out monthly usage, see what type of space is needed and consider repurposing underutilized space once those spaces are identified
- Establish ongoing fund-raising campaign with consideration given to operation funds and staffing, and capital needs
- Review the capital campaign feasibility study with Alexander Haas
- Set up a yearly or quarterly meeting between HB Foundation, the Botanical Garden committee chair, station Director and Associate Director, a representative (or two) of the Board of Scientific Advisors and others to coordinate efforts to review and set funding priorities.
- Explore ways to fund an artist in residence; the HBS art component is an intrinsic part of the buildings and can easily lead to development opportunities.

Threats:

- Disconnect between the HB Foundation and Biological Station missions.
- Loss of research and education as the top priorities.
- Aesthetic improvements may displace substantial mission related needs.

VII. Summary of Unit Strengths and Areas for Improvement

The review team found the Highlands Biological Station in excellent condition. The field station reflects both expected and recommended goals, mission, and many achievements based on national standards for comparable facilities (*Field Stations and Marine Laboratories of the Future: A Strategic Vision* (Billick *et al.* 2013; www.obfs.org/assets/docs/fsml_final_report.pdf), the goals and mission of the University of North Carolina system, and Western Carolina University (including WCU's *2020 Vision Plan*). The team was especially impressed with the comprehensive, broad, and detailed analysis presented in the Executive Director's Self Study which the team found remarkably accurate and in many regards in line with this report.

As enthusiastically relayed to the review team by a station scientist during one of the visit teleconferences with facility users, Highlands Biological Station is a "bright light" in the UNC system. HBS holds several invaluable assets, including its location, rich biological resources, long history and tradition of place-based biological research, its tight coalition of supporting member institutions, its committed researcher base, and its local and HB Foundation support. The facility offers teaching and research opportunities and an academic environment unique within the UNC system, and indeed the state of North Carolina. There are few academic settings where undergraduate and graduate students, faculty, other scientists, and members of the public, have the chance to engage and learn from each other in as direct, interactive, and mutually supportive way as at a biological field station like HBS.

U.S. biological field stations, as a group, have found themselves in jeopardy in recent years and many have struggled to maintain programs with minimal budgets. And because field stations often serve relatively small audiences, they are often targets for cuts. The robust and vibrant programs at HBS are an inspiration - especially the education and outreach programs. It is critical that UNC and WCU understand the value of high quality gems like HBS in their care.

Overall the major strengths of the Highlands Biological Station are reflected in the impressive undergraduate instructional program which includes both summer and fall semester programs (an important and unusual season), and a comprehensive and very high quality public outreach program including the Nature Center, public school program, and Botanical Garden. The research program at the field station is also impressive, but may over rely on a narrow research focus, and on an aging PI demographic. The instructional program most importantly requires faculty compensation parity to retain high quality instructors. Outreach programs require commitment to staff positions and funding. The research program can be stimulated relatively easily with an expanded Grants-in-Aid program targeting regional and national early career faculty and a commitment to attractive and available housing. A commitment to staff, information technology and data management, research support, and facilities support will also increase activity in all programs.

VIII. Appendix**Site Visit Schedule and Meeting Attendees:**

DATE/TIME	ACTIVITY	LOCATION
Sunday, August 23rd		
6:00 PM	Dinner Meeting with Review Team and Dr. Alison Morrison-Shetlar (Provost)	Courtyard Dining Hall {Provost will pick-up/return External Reviewers to Comfort Inn}
Monday, August 24th		
6:45 AM	Commute to WCU Campus	David Onder will pick up External Reviewers at Comfort Inn, Sylva and drive them to Courtyard Dining Hall, WCU Campus.
7:00 – 7:45 AM	Breakfast Meeting with Review Team, Dr. Carol Burton (Associate Provost for Undergraduate Studies) & Mr. David Onder (Assessment Director)	Courtyard Dining Hall
8:00 – 8:50 AM	Meeting with Review Team & Dr. Brandon Schwab (Associate Provost for Academic Affairs)	540 HFR Administration. Building
9:00 – 10:00 AM	Meeting with Review Team, Dr. Richard Starnes (Dean, College of Arts & Sciences), Dr. Sean O'Connell (Biology Department Head), Dr. Indi Bose (Biology), Dr. Brian Byrd (Health Sciences), Dr. Kefyn Catley (Biology), Dr. Mary Ella Engel (History), & Dr. Jeremy Hyman (Biology)	540 HFR Administration. Building
10:00 – 11:00 AM	Transition to Highlands Biological Station (HBS)	Dr. Kloeppe will pick up review team at 10:15 in front of HFR
11:00 AM– 12:30 PM	Meeting with Review Team, Tour of Facility & Dr. James Costa (Director, HBS)	HBS

DATE/TIME	ACTIVITY	LOCATION
12:30 - 2:00 PM	Lunch Meeting – Review Team & HBS Staff: Cynthia Soderstrom, (Business Manager); Russell	HBS Seminar Room {Mountain Fresh Grocery Store will deliver lunch
2:00 - 2:45 PM	Meeting with Review Team, Select Community & HBS Foundation Board Members: Ms. Julia	HBS
3:00 – 3:45 PM	Conference Call with Review Team, Recent HBS Faculty & Students: Ms. Jessica Allen (New York Botanical University); Dr. Joey Shaw (UT Chattanooga) Will attend meeting in person: Eric	HBS
4:00 – 4:45 PM	Meeting with Review Team, Current HBS Faculty & Students: Dr. Steph Jeffries (North Carolina State	HBS
5:00 – 6:30 PM	Dinner – Review Team	HBS Seminar Room {Mountain Fresh Grocery Store will deliver dinner
6:30 – 7:30 PM	Transition to Comfort Inn, Sylva	Dr. Kloepfel will drive External Reviewers back to Comfort Inn, Sylva
Tuesday, August 25th		
6:30 – 7:30 AM	Breakfast – External Reviewers	Comfort Inn, Sylva
7:40 AM	Commute to WCU Campus	David Onder will pick up External Reviewers at Comfort Inn, Sylva and drive
8:00 – 8:45 AM	Meeting with Review Team & Select WCU Faculty (Including Library) & Staff – Mr. Timothy Carstens	452 HFR Administration. Building
9:00 – 9:45 AM	Conference Call with Review Team & Select HBS Board of Directors – Dr. Patrick Abbott (Vanderbilt University), Dr. Christopher Brown (UNC General Administration), Dr. Paul Manos (Duke University), & Dr.	452 HFR Administration. Building

DATE/TIME	ACTIVITY	LOCATION
10:00 – 10:45 AM	Conference Call with Review Team & Select Board of Scientific Advisors – Dr. Rob Baldwin (Clemson	452 HFR Administration. Building
10:45 AM – 1:00 PM	Brief Work Meeting and Lunch – Review Team Only	452 HFR Administration. Building
1:00 – 2:00 PM	Exit Meeting with Review Team & Costa, Morrison-Shetlar, Schwab, Burton & Onder	452 HFR Administration. Building
2:00 PM	Depart campus	David Onder will return External Reviewers to Comfort Inn, Sylva