CEDAR POINT BIOLOGICAL STATION
VISIONING MASTER PLAN

JANUARY 19, 2016
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PROJECT BRIEF

This visioning master plan document presented to the University of Nebraska-Lincoln is intended to define planned improvements and deferred maintenance to the Cedar Point Biology Station in Ogallala, Nebraska. The key focus points in this document are: 1) highlighting areas of site improvement recommended by HDR, Inc. and CPBS staff and the costs associated with maintaining or replacing these areas; 2) assessing Goodall Lodge including options for maintenance, renovation, or replacement and costs associated with each option; 3) examine possible energy efficiency improvements including new systems and alternative energy methods; as well as the initial costs for these systems and the payback period associated with them.

USING THIS DOCUMENT

HDR intends for this document to be an itemized and graphic guideline for improvement options envisioned for the Cedar Point Biology Station. This document provides many unbiased options for each of the three aforementioned areas of focus, and the costs associated with them. It should be considered a reference guide for the University of Nebraska-Lincoln to make well-informed decisions regarding deferred maintenance and campus improvements at the CPBS.

HDR RECOMMENDATIONS

While the intentions of this document are to provide a register of improvement options, HDR will provide professional recommendations regarding a course of action while considering a current budget. These recommendations can be found on page 59.
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BUILDING INDEX

1. KILLIFISH CABIN
2. LUBBER LAB
3. SWALLOW BARN
4. MIDGE
5. PRICKLY PEAR
6. PENSTEMON
7. OLD GARAGE
8. NEW GARAGE
9. BLUESTEM
10. LOCUST
11. GOODALL LODGE
12. GAINSFORTH
13. STUDENT WASH HOUSE
14. WORLD HERALD
G1-7. GIRLS CABINS
B1-6. BOYS CABINS
AREAS INDEX

AREA ONE
STUDENT CABINS
WASHROOM CABIN

AREA TWO
GOODALL LODGE
GAINSFORTH
FACULTY CABIN
GRADUATE STUDENT CABIN

AREA THREE
ACCESSIBLE CABIN
FACULTY CABIN
PARKING AREA
AREA ONE IMPROVEMENTS

IMPROVE DRAINAGE
IMPROVE PATHS
CONSTRUCT RETAINING WALLS
REPLACE BRIDGE OVER CREEK
AREA ONE IMPROVEMENTS

IMPROVE DRAINAGE

- Construct and utilize swales to redirect water around washhouse (Cabin 13)
- Direct water runoff to main drainage creek
- Construct retaining walls to slow down water runoff

Fig 7 Fig. 1: Typical cabin upgrades (girls cabins).
AREA ONE IMPROVEMENTS

IMPROVE PATHS

- Make paths accessible
- Construct new concrete paths from main social area and Goodall lodge to girls cabins
- Walking paths have 5% slope / 2% cross-slope max
- Ramps have 8% slope max with handrails
- Build switch-back ramps to level out severe grade changes
- Use non-native tree clearing as a source for constructing retaining walls
- Build new stairs off path for direct access to wash-house cabin
AREA ONE IMPROVEMENTS

CONSTRUCT RETAINING WALLS

• RULE: CONSTRUCT RETAINING WALLS TO TERRACE THE LANDSCAPE IN AREAS WHERE MOWING IS REQUIRED.

• RETAINING WALLS SHOULD BE CONSTRUCTED OF LOCALLY COLLECTED LARGE ROCKS AND BOULDERS (SEE PG 8, FIG. 1) OR TIMBERS MADE FROM LOCALLY CLEARED TREES.
AREA ONE IMPROVEMENTS

REPLACE PATH OVER CREEK

- CONSTRUCT A NEW BRIDGE THAT OFFERS BETTER ACCESSIBILITY
- BRIDGE NEEDS TO BE ABLE TO SUPPORT LIGHT VEHICLE TRAFFIC
- BRIDGE BECOMES A SOCIAL GATHERING SPACE
- POSSIBLY CONSTRUCT A CULVERT SYSTEM. A CULVERT WOULD REQUIRE LESS MAINTENANCE BUT WOULD REQUIRE A GREATER NEGATIVE IMPACT ON THE SITE

Fig 10: Existing bridge. New bridge elevation needs to increase 8'-0" to 10'-0" above existing.
AREA ONE IMPROVEMENTS

BRIDGE / CULVERT COMPARISON

- CULVERT SUPPORTS HEAVIER TRAFFIC
- COVERED BRIDGE HAS LESS IMPACT ON SITE
- CULVERT HAS MORE MAINTENANCE ISSUES FROM CLEARING JAMS
- BRIDGE ALLOWS A GREATER FLOW OF WATER
- CULVERT HAS LOWER INITIAL COST
- CULVERT DOESN'T REQUIRE REPLACEMENT OF MATERIALS
- CULVERT HAS LONGER LIFE SPAN
- BRIDGE HAS GREATER POTENTIAL FOR DONORS
AREA ONE IMPROVEMENTS

BRIDGE / CULVERT COMPARISON

- Construct a new bridge that offers better accessibility
- Bridge needs to be able to support light vehicle traffic
- Bridge becomes a social gathering space
- Possibly construct a culvert system. A culvert would require less maintenance but would require a greater negative impact on the site.

EXISTING BRIDGE ELEVATION
NEW BRIDGE ELEVATION

+/- 240 Cubic Yards of fill (conceptual estimate)
AREA TWO IMPROVEMENTS

- Improve Access Road
- Improve Drainage
- Add Drainage Basin with Culvert
- Improve Paths
- Improve Social Space
- Maintain Parking
AREA TWO IMPROVEMENTS

IMPROVE ACCESS ROAD

1. RESURFACE MAIN ROAD WITH RIVER COBBLE / MUD ROCK
2. LOWER DOCK ELEVATION TO SEMI-TRUCK HEIGHT
3. PROVIDE LARGE PAD OF 8" REINFORCED CONCRETE AT GOODALL DOCK
4. NEW STEEL HANDRAILS
5. NEW ACCESS RAMP

Fig 14: Existing loading dock conditions at Goodall Lodge.
AREA TWO IMPROVEMENTS

GOODALL LODGE IMPROVEMENT

- PROVIDE ACCESSIBLE ENTRY TO GOODALL LODGE FROM COURTYARD
- CONSTRUCT A DECK AREA OUTSIDE ENTRY DOOR
- LARGE DECK COULD BE SOCIAL GATHERING SPACE
- LARGE DECK WOULD MAKE ENTRY MORE ACCESSIBLE AND RELIEVE DRAINAGE ISSUES AROUND THE LODGE
- LARGE DECK COULD CONNECT TO PATH NETWORK AS ACCESSIBLE ROUTE
- DECK COULD BE CONSTRUCTED OF PERMATRACK CONCRETE BOARDWALK ($45-$85/SF; http://www.permatrak.com/)

Fig. 1: Suggestion for accessible entry at Goodall Lodge.
Fig. 2: Example of elevated concrete boardwalk.
AREA TWO IMPROVEMENT

GOODALL LODGE IMPROVEMENT

• PROVIDE IMPROVED DRAINAGE TO THE SOUTHWEST CORNER OF GOODALL LODGE
• CONSTRUCT SAFER, MORE ACCESSIBLE STAIR WITH HANDRAILS AND GUARDRAILS
• CONSTRUCT GABIAN WALL TO CREATE A FEATURE WALL
AREA TWO IMPROVEMENT
GOODALL LODGE IMPROVEMENT

- Construct new concrete ramp, ADA accessible, around the east side of Goodall Lodge that connects the upper level and bottom level.

Fig 17 Fig. 1: New ramp location at Goodall Lodge.
AREA TWO IMPROVEMENT

GOODALL LODGE IMPROVEMENT

- Construct new ADA accessible ramp to get to the lower level of Goodall Lodge from the concrete loading dock.
- New ramp to have required guardrail and handrail.
- New ramp to be incorporated into retaining wall.

Fig 18 Fig. 1: New ramp location at Goodall Lodge loading dock.
AREA TWO IMPROVEMENTS

IMPROVE DRAINAGE

- INSTALL RETAINING WALL TO DIVERT WATER AROUND ROADS AND PATHS
- CONSTRUCT AND UTILIZE SWALES TO CONTROL RUNOFF WATER
- INSTALL NEW, LARGE, DRAINAGE BASIN AND CULVERT TO RE-DIRECT EXCESS WATER RUNOFF

Pg 19 Fig. 1: Controlled water runoff from cabins across the loading dock at Goodall Lodge.

Pg 19 Fig. 2: Controlled water runoff down drive.

Pg 19 Fig. 3: Controlled water runoff down drive.
AREA TWO IMPROVEMENTS

ADD DRAINAGE BASIN WITH CULVERT

• DEMOLISH EXISTING CONCRETE CULVERT BY BLUESTEM CABIN.
• DIRECT WATER RUNOFF TO A NEW DRAINAGE BASIN. NEW DRAINAGE BASIN TO DRAIN TO NEW CULVERT.
• NEW CULVERT AND DRAIN PIPE TO DAYLIGHT ON NORTH SIDE OF SITE.

Fig. 1: Existing culvert at Bluestem Cabin. To be demolished.
AREA TWO IMPROVEMENTS

IMPROVE PATHS

- MAKE PATHS ACCESSIBLE
- WALKING PATHS HAVE 5% SLOPE / 2% CROSS-SLOPE MAX
- RAMPS HAVE 8% SLOPE MAX WITH HANDRAILS
- RAISE ELEVATION OF PATHS TO ALLOW BETTER ACCESS TO CABINS
AREA TWO IMPROVEMENTS

IMPROVE SOCIAL SPACE

- Construct boardwalk deck with incorporated seating
- Add lighting and safety features to social areas
- Define edges of gathering area
- Create a sense of character within common areas
AREA TWO IMPROVEMENTS

MAINTAIN PARKING

- MAKE PARKING AREAS MORE CLEARLY DEFINED
- ADD GRAVEL OR ROCK TO STABILIZE PARKING AREAS
- UTILIZE IMPERVIOUS PARKING MATS TO RETAIN GRAVEL.
IMPROVE DRAINAGE

- BUILD SWALES TO DIVERT WATER BESIDE ROADS AND PATHS
- CONSTRUCT RETAINING WALLS USING TREES FROM SITE CLEARING AND LOCALLY COLLECTED BOULDERS TO PREVENT WATER RUNOFF FROM ENTERING GARAGE OF LUBBER LAB.
AREA THREE IMPROVEMENTS

PROVIDE NEW ACCESSIBLE PATHS

- PROVIDE AN ACCESSIBLE PATH FROM ACCESSIBLE CABIN TO GOODALL LODGE.
- CREATE NEW, LOW-SLOPE, PATH AROUND PRICKLY PEAR CABIN.
- NEW PATHS TO HAVE CONCRETE PAVING.
- DECOMMISSION EXISTING PATH WITH EXCESSIVE SLOPE.

Fig 26 Fig. 1: Decommission non-accessible path to Goodall Lodge. Add new accessible path.
CAMPUS SITE IMPROVEMENTS

SUMMARY

1. IMPROVE DRAINAGE
2. LOWER DOCK ELEVATION AND RESURFACE MAIN ROADS
3. IMPROVE PATHS AND MAKE THEM MORE ACCESSIBLE
4. MAINTAIN PARKING CAPABILITIES
5. INCREASE AND IMPROVE SOCIAL GATHERING SPACES
6. REPLACE BRIDGE
CAMPUS SITE IMPROVEMENTS

SUMMARY

1. IMPROVE DRAINAGE
2. RESURFACE MAIN ACCESS ROAD AND LOWER DOCK ELEVATION
3. IMPROVE PATHS AND MAKE THEM MORE ACCESSIBLE
4. MAINTAIN PARKING CAPABILITIES
5. INCREASE AND IMPROVE SOCIAL GATHERING SPACES
6. REPLACE BRIDGE

LEGEND

PATHS
STAIRS
DRAINAGE
SOCIAL AREA
PRAIRIE GRASS
RETAINING WALL
DRAINAGE INLET
RESURFACE ROAD
SEWER DRAIN FIELD
PARKING AREA TO REMAIN
REPLACE PATH OVER CREEK
TERRACE GRASS FOR MOWING
8" THICK REINFORCED CONCRETE
CAMPUS SITE IMPROVEMENTS

BUDGET COST ESTIMATIONS

1. REMOVE AND HAUL-OFF EXISTING WOOD BRIDGE
   700 SF x $12/SF = $8,400

2. 8’ DIAMETER CONCRETE CULVERT
   30 LF x $250/LF = $7,500

3. COMPACTED BACKFILL AT CULVERT
   240 CY x $25/CY = $6,000

4. WOOD BRIDGE - 10' WIDE WITH WOOD ROOF
   1,200 SF x $45/SF = $54,000

5. IMPROVE DRAINAGE WITH SWALES AND SEEDING
   3,000 LF x $35/LF = $105,000

6. CONCRETE SIDEWALKS AND PATHS
   4,850 SF x $5/SF = $24,250

7. RESURFACE MAIN ROADS
   36,390 SF x $3.50/SF = $127,370

8. IMPERVIOUS PARKING AREA WITH ROCKS
   6,600 SF x $15/SF = $99,000

9. RETAINING WALLS - Gabion with Wire
   800 SF x $21/SF = $16,800

10. RETAINING WALLS - Concrete
    800 SF x $34/SF = $27,200
CAMPUS SITE IMPROVEMENTS

BUDGET COST ESTIMATIONS

11. REMOVE AND HAUL-OFF EXISTING CONCRETE
   3,000 SF x $8/SF = $24,000

12. REINFORCED CONCRETE LOADING DOCK
   2,800 SF x $6/SF = $16,800

13. RAISE EXISTING CONCRETE DOCK HEIGHT
   300 SF x $15/SF = $4,500

14. STEEL HANDRAILS AT DOCK STAIRS
   100 LF x $30/LF = $3,000

15. CONCRETE A.D.A. ACCESS RAMPS / HANDRAILS
   1,100 LF x $40/LF = $44,000

16. RESURFACE WALKING PATHS
   6,000 SF x $4/SF = $24,000

17. UNDERGROUND DRAINAGE PIPE
   350 LF x $30/LF = $10,500

18. LARGE CONTAINMENT BASIN
   1 UNIT x $25,000/EACH = $25,000

19. WOOD BOARDWALK DECKS AND SEATING AT LODGES
   1,700 SF x $20/SF = $34,000

20. CONCRETE STAIRS / HANDRAILS
   60 TREADS x $600/TREAD = $36,000
CAMPUS SITE IMPROVEMENTS

BUDGET COST ESTIMATIONS

21. REMOVE AND HAUL-OFF EXISTING CULVERT @ BLUESTEM CABIN
   1 UNIT x $3,000/UNIT = $3,000

22. CONCRETE DRAINAGE BASIN AT BLUESTEM CABIN
   1 UNIT SF x $8,500/UNIT = $16,800

23. METAL CULVERT AND DRAIN PIPE TO DAYLIGHT DRAINAGE BASIN
   1 SYSTEM x $5,000/SYSTEM = $5,000

24. EARTHWORK AND SEEDING FOR WATER RUN-OFF @ LUBBER LAB
   2,000 SF x $10/SF = $20,000

SUBTOTAL:
   $733,820.00

ADDED ITEMS:
General Conditions, Overhead, Profit, Insurance, Bond (15%)
Design Contingency (5%)
Escalation (5%)

CONSTRUCTION TOTAL:
   $930,380.00
GOODALL LODGE ASSESSMENT

FACILITY ASSESSMENT

IMMEDIATE IMPROVEMENTS

COMpletely REvOvATE GOODALL LODGE

NEW OUTDOOR LAB ADDIITION

NEW STAND-ALONE LAB / CLASSROOM
<table>
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<th>GOODALL LODGE</th>
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**Architectural**

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<tr>
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<td>2 2</td>
</tr>
<tr>
<td>Walls</td>
<td>2 2</td>
</tr>
<tr>
<td>Floors</td>
<td>3 3</td>
</tr>
<tr>
<td>Ceilings</td>
<td>3 3</td>
</tr>
<tr>
<td>Fixed Furnishings</td>
<td>1 1</td>
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**Life Safety**

| Means of Egress    | 1 1                                                                      |
| Roof Fall Protection| X  X                                                                    |

**Accessibility**

C: Compliant with ADA; A: Accessible; N: Not Accessible

| Signage            | N  N                                                                     |
| Restrooms Men      | N  N                                                                     |
| Restrooms Women    | N  N                                                                     |
| Vertical Access    | N  N                                                                     |

**Entrances**

C: Compliant with ADA; A: Accessible; N: Not Accessible

| North               | N  N                                                                     |
| South               | N  N                                                                     |
| East                | N  N                                                                     |
| West                | N  N                                                                     |
| Other               | N  N                                                                     |

**Exterior**

4 Excellent; 3 Adequate; 2 Minor Renovation; 1 Major Renovation; X Missing & Needed

| Walls               | 1 1                                                                      |
| Renovation          | 1 1                                                                      |
| Doors               | 1 1                                                                      |
| Roof                | 1 1                                                                      |
| Foundations and Footings | 2 2                                                                  |
| Basements           | 2 2                                                                      |

**Superstructure**

4 Excellent; 3 Adequate; 2 Minor Renovation; 1 Major Renovation; X Missing & Needed

**Structural Frame**

3 3

**MEP**

Plumbing System

4 Excellent; 3 Adequate; 2 Minor Renovation; X Missing & Needed

| Fixtures           | 2 2                                                                      |
| Water Piping Inside Building | 2 2                                                                  |
| Sanitary Vent Piping      | 2 2                                                                      |
| Water Service          | 2 2                                                                      |
| Storm Piping           | 2 2                                                                      |
| Hot Water source       | 2 2                                                                      |
| Natural Gas Piping     | 2 2                                                                      |
| Laboratory Piping     | X  X                                                                     |

HVAC System

4 Excellent; 3 Adequate; 2 Minor Renovation; 1 Major Renovation; X Missing & Needed

| Fuel Oil System                | 1                                                                        |
| Primary Heating Source         | 1                                                                        |
| Primary Cooling Source         | 1                                                                        |
| Air System Equipment           | 1                                                                        |
| Air System Distribution        | 1                                                                        |
| Hydronic Water Piping          | 1                                                                        |
| Steam Piping                   | 1                                                                        |
| Building Controls              | 1                                                                        |
| Laboratory Exhaust System      | 3                                                                        |
| Laboratory Hoods/Controls      | 3                                                                        |
| Computer Room AC Equipment     | 3                                                                        |

Fire Protection

4 Excellent; 3 Adequate; 2 Minor Renovation; 1 Major Renovation; X Missing & Needed

<p>| Fire Service                  | X                                                                        |
| Standpipes                    | X                                                                        |
| Sprinkler System              | X                                                                        |</p>
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**Electrical System**

1. Service Entrance: 1
2. Distribution: 1
3. Lighting: 1
4. Exit Signs: 1
5. Fire Alarm System: X
7. Lighting Controls: 1
10. Phone/Data System: 1
11. Quantity of Receptacles: 1

**Conveying Systems**

1. Elevators and Lifts: X

4 Excellent; 3 Adequate; 2 Minor Renovation; 1 Major Renovation; X Missing & Needed
GOODALL LODGE ASSESSMENT

FACILITY IMPROVEMENT OPTIONS

- PROVIDE ACCESSIBLE ENTRY TO GOODALL LODGE FROM COURTYARD
- PROVIDE ACCESSIBLE ACCOMMODATIONS IN GOODALL INTERIOR
- IMPROVE ROOF CONDITION (NEW SHINGLES OR METAL ROOF)
- REPLACE HVAC AND ELECTRICAL SYSTEMS
- REPLACE WINDOWS
- INSULATE SPACE

*ALL OF THESE OPTIONS ARE MAINTENANCE ITEMS THAT SUSTAIN THE CURRENT FUNCTION OF GOODALL LODGE.*

Fig. 1: Existing condition of Goodall Lodge.
GOODALL LODGE ASSESSMENT

COMPLETELY RENOVATE GOODALL LODGE

- A COMPLETE RENOVATION WOULD REQUIRE THE COMPLETE GUTTING OF THE INTERIOR AND REPLACEMENT OF MECHANICAL SYSTEMS, ELECTRICAL SYSTEMS, WALL INSULATION, MATERIAL FINISHES, DOORS AND WINDOWS.
- A COMPLETE RENOVATION OF GOODALL LODGE WOULD INCLUDE THE REPLACEMENT OF INADEQUATE KITCHEN EQUIPMENT, INCLUDING A NEW HOOD.
- NEW FEATURES WOULD BE DESIGNED TO ENHANCE USER EXPERIENCE AND VIEWS.

Fig. 1: Conceptual rendering of Goodall Lodge interior renovation
GOODALL LODGE ASSESSMENT

NEW OUTDOOR LAB

- CONSTRUCT A NEW FREE STANDING OUTDOOR LAB
- NEW LAB WOULD BE OPEN-AIR, SHADED, NON-CONDITIONED SPACE
- NEW LAB WOULD BE FOR LARGE DISSECTIONS AND OUTDOOR EXPERIMENTS

Fig 1: Suggested area of new outdoor lab addition at Goodall Lodge.
GOODALL LODGE ASSESSMENT

NEW STAND-ALONE LAB / CLASSROOM

- BUILD A NEW STAND-ALONE LAB / CLASSROOM IN A SITE THAT OFFERS DIRECT VIEWS OF THE LAKE.
- THIS BUILDING SITE WOULD RECEIVE ACCESS FROM THE NEWLY ESTABLISHED WEST ACCESS ROAD.
- AN ALTERNATIVE BUILDING SITE COULD HAVE A DIRECT CONNECTION TO THE NEWLY ACTIVATED COURTYARD AREA.
- NEW BUILDING WOULD BE CONSTRUCTED INTO THE NATURAL SLOPE OF THE SITE IN A SUSTAINABLE AND INNOVATIVE WAY.

PG 38 Fig. 1: Conceptual rendering of future classroom / lab space.

PG 38 Fig. 2: Conceptual rendering of future classroom / lab space.
GOODALL LODGE IMPROVEMENTS

BUDGET COST ESTIMATIONS

1. GOODALL LODGE RENOVATION
   5,700 SF x $232.22/SF = $1,323,660

2. GOODALL LODGE OUTDOOR CLASSROOM ADDITION
   400 SF x $126.80/SF = $50,720

3. NEW LAB BUILDING
   5,000 SF x $253.98/SF = $1,267,900

INCLUDED ADDED ITEMS:
General Conditions, Overhead, Profit, Insurance, Bond (15%)
Design Contingency (5%)
Escalation (5%)

CONSTRUCTION TOTAL:
$2,642,280.00
ENERGY IMPROVEMENTS

UPDATING MECHANICAL AND ELECTRICAL SYSTEMS, EQUIPMENT, AND TECHNOLOGY
ELECTRICAL NARRATIVE

Existing Goodall Lodge

Normal Power Distribution System:

A verification of current electrical loads on the cabin will determine whether or not new electrical circuit breakers will be needed to add to the existing panel to serve the new VRF system and the additional mechanical systems.

Fire alarm system:

Code compliant fire detection and signaling will be provided for the existing building.

Lighting:

LED and fluorescent lighting shall be used to replace existing bulbs or fixtures as applicable.
New Classroom / Lab Building

Normal Power Distribution System:
A separate electrical service will be provided for the new building.

Lighting:
LED lighting shall be used predominantly in the new building.
Exit signs shall be LED edge-lit type in public areas.

The lighting in the classrooms will be controlled by a networked low voltage relay switching system. This system will include programmed ON/OFF operation with local manual override capabilities. Interior photocells will be used for control of interior areas where daylight contribution is significant.

Occupancy sensors will be provided in restrooms, support spaces, and storage rooms.

Fire alarm system:
General: A Code required fire alarm system will be provided in the new building. Fire alarm devices shall be addressable, intelligent, automatic and manual initiation devices and audio/visual alarm devices. Alarm activation will be initiated by manual pull stations, smoke detection, heat detection, and fire sprinkler water flow devices. Alarm indication will consist of visual and combination visual/voice evacuation devices located and installed in accordance with NFPA 72 and the ADA. All fire alarm wiring will be in conduit.

ADA compliant flashing lights shall be provided at all corridors, public spaces, toilets and common use spaces.
Audible alarm and flashing lights shall be combination devices.
LED type indicators shall be provided for remote indication that a heat and/or smoke sensor has been activated in a location of room located outside room adjacent to door, duct sensors that are not readily visible (located on ceiling or at visible location nearest to sensor installation).

Provide gelled electrolyte type batteries with overcharge protection for all transponders. Provide solid state battery charger(s) with capacity to recharge entire battery system in 4 hours. Batteries shall have capacity to operate entire system except magnetic door holders for 1-1/2 hours with 25 percent spare capacity.

Provide a minimum of 2 isolation modules per floor for alarm circuits to isolate wire to wire shorts.

Telecommunications Infrastructure:
A complete pathway system shall be provided to serve voice and data system cabling needs for the facility. A properly sized cable management system consisting of cable tray shall be installed throughout the entire corridor system of the facility to serve cabling.

Voice and data outlets shall consist of a 2 gang junction box at each location with a 1 inch conduit stubbed to nearest cable tray from each outlet.

Empty Conduit Systems:
General: Certain systems will not be provided as part of the base contract as noted below. Empty conduit and junction boxes will be provided for such systems as required. Stub-outs, where indicated, will be provided to cable management system.

Monitoring:
The main panel shall have monitoring provisions for voltage, phase, neutral and ground amperage, and power factor.
ELECTRICAL NARRATIVE

General

Normal Power Distribution System:

Overhead utility power poles run throughout the site. Additional pole mounted primary feeders and pole mounted transformers required for new buildings will be provided by the electrical utility while all secondary conductors will be the owner’s responsibility. Routing of the utility secondary feeders will follow a path that causes minimum disruption to existing construction.

Copper phase, neutral and ground bus bars will be used for all panelboards. 240V shall be used for interior distribution and motor circuits.

Circuit breaker panelboards shall be provided for 240 volt distribution. All panels shall be fully rated to handle available fault current ratings. Series rating of breakers and panelboards is not acceptable.

Equipment located in damp or wet locations shall be NEMA 3R rated.

Lighting:

In general, the lighting intensities shall be based on the recommendations of the Illuminating Engineering Society. All lighting fixtures shall be premium grade, and all lighting toggle switches shall be heavy duty specification grade.

Lighting control devices such as occupancy sensors, astronomical time clocks, and photo cells will be provided as appropriate to be compliant with state energy code.

Basic Electrical Materials and Methods:

All 120 volt circuiting shall be installed in conduit.

Rigid galvanized steel conduit shall be used underground, outdoors, in concrete, under concrete slabs on grade, in exterior masonry walls, in wet locations, for exposed runs below 10 FT above floor, for feeders over 600 volts and in explosion-proof areas.

EMT conduit shall be used for other indoor, dry locations. Provide galvanized malleable iron or steel compression fittings, water and concrete-tight type.

PVC conduit may be used underground.

Steel conduits in contact with earth or a vapor barrier shall be PVC coated or protected with 2 coats of asphaltum.

Copper conductors will be base bid throughout the project.

MC cable is not allowed.

Branch circuits whose length from panel to first outlet exceeds 75 feet for 120 volt circuits shall be #10 minimum.

Number 10 AWG and smaller wire shall be solid conductor except for motor circuit feeders. Number 8 AWG and larger and motor circuit feeders shall be stranded conductors. Provide THHN insulation except in wet locations, underground and for circuiting from ground fault circuit interrupters where type XHHW insulation shall be used.

4 IN high reinforced concrete pads will be provided for all floor-mounted electrical equipment.

Lighting circuits shall be loaded to a maximum of 1600 VA for 120 volt circuits.

A maximum of 6 general use receptacles shall be served by one 20 amp circuit.

Receptacle Outlets:

20A 125V extra-heavy duty grade duplex receptacles shall be provided in all rooms.

One (1) duplex receptacle shall be provided for approximately every 25 SQ FT of all support space.

Receptacles shall be provided in corridors and along pathways at 30'-0" on center for general use equipment.

One (1) duplex receptacle shall be provided for approximately every 400 SQ FT of storage and garage space.

20A 125V GFCI duplex receptacle shall be provided in toilet rooms adjacent to lavatory and all receptacles within 6 FT of sinks.

Device plates shall be 302 stainless steel. All plates will be engraved with the appropriate circuit number.

Grounding:

Main ground: per National Electrical Code.

Provide a running green ground wire with all feeder and branch circuits.
**ELECTRICAL ASSESSMENT**

1. **KILLIFISH CABIN**

   **IMPROVEMENTS:**
   
   (870 SF x $3.00/SF) Electrical Panel, Lights, Outlets
   
   **COST:** $2,610

2. **LUBBER LAB**

   **IMPROVEMENTS:**
   
   (2,145 SF x $3.00/SF) Electrical Panel, Lights, Outlets
   
   **COST:** $8,580

3. **SWALLOW BARN**

   **IMPROVEMENTS:**
   
   (825 SF x $3.00/SF) Electrical Panel, Lights, Outlets
   
   **COST:** $2,480

4. **MIDGE HOUSE**

   **IMPROVEMENTS:**
   
   (1,170 SF x $3.00/SF) Electrical Panel, Lights, Outlets
   
   **COST:** $3,510
ELECTRICAL ASSESSMENT

5. PRICKLY PEAR

IMPROVEMENTS:
(1,560 SF x $3.00/SF) Electrical Panel, Lights, Outlets

COST:
$4,680

6. PENSTEMON

IMPROVEMENTS:
(400 SF x $3.00/SF) Electrical Panel, Lights, Outlets

COST:
$1,200

9. BLUESTEM

IMPROVEMENTS:
(900 SF x $3.00/SF) Electrical Panel, Lights, Outlets

COST:
$2,700

10. LOCUST

IMPROVEMENTS:
(700 SF x $3.00/SF) Electrical Panel, Lights, Outlets

COST:
$2,100

12. GAINSFORTH LODGE

IMPROVEMENTS:
(9,900 SF x $3.00/SF) Electrical Panel, Lights, Outlets

COST:
$39,600
Two studies were done to evaluate photovoltaic systems that could produce 5% and 10% of the site's annual electricity usage to give an idea of the area required for the systems, as well as the potential cost.

The approximate kWh used by the site during 2014 was 154,082, with an associated cost of $13,097. Based on data from NREL (National Renewable Energy Laboratory), a 5 kW solar array will be able to produce 7,774 kWh per year, which is approximately 5% of 2014's usage. Subsequently, a 10 kW solar array can produce 15,548 kWh per year, which is approximately 10% of 2014's usage. Please note though, the solar panel array would only be able to feed into one electrical panel, so choosing a panel that feeds a significant load on the site would be a good choice.

Based on using a 72 cell solar panel module that can produce 305-315 Watts, 16 panels would be needed for the 5 kW solar array. The total area of the panels is 343 square feet, so this would be the absolute minimum ground/surface area needed for installing the panels. The 10 kW array is simply a double of the 5 kW array, which requires 32 panels and yields a panel area of 686 square feet.

Costs for a photovoltaic installation vary, but are approximately $5 per Watt generated, so the total installed cost for the 5 kW system would be approximately $25,000. Based on an estimated utility rate of $.085/kWh, the approximate payback, not including any grants or tax credits to help offset the initial cost, is 38 years. The cost and production for the 10 kW system are simply double the 5 kW system, so the payback is the same, 38 years.
SOLAR PANEL OPTION

ELECTRICAL ENGINEERING NOTES:

Seeing the map (at right), the majority of the roofs on the campus are not conducive to applying solar panels (also visual appearance). It is HDR’s recommendation to use a ground mounted photovoltaic array.

Map Key:

- Mostly South-facing roofs
WIND POWER OPTION

ELECTRICAL ENGINEERING NOTES:

The annual average wind speed at 30 meters above the ground is approximately 6.0 - 6.5 meters/second. Based on this data, and using a 30 kW wind turbine, an annual energy output of between 67,000 kWh and 78,000 kWh can be achieved. Approximate kWh used by the site during 2014 was 154,082, with an associated cost of $13,097, so a wind turbine could provide a substantial amount of energy production for the site. Please note though, the turbine would only be able to feed into one electrical panel, so choosing a panel that feeds the most significant load on the site would be the best choice.

As a point of reference, the 5 kW turbine by Weaver Wind Energy that was mentioned through correspondence has an annual energy output between 4,399 kWh and 4,587 kWh.

Total installed cost for the 30 kW turbine with a 100 foot tilt-down pole is $227,500. Based on an estimated utility rate of $.085/kWh, the approximate payback, not including any grants or tax credits to help offset the initial cost, is 37 years.
MECHANICAL NARRATIVE

General

The current scope of the master planning vision study will be to replace existing systems within Goodall Lodge, and look at the possibility of adding a new, stand-alone, classroom and lab building. Similar systems upgrades can be added to various buildings on the Cedar Point Biology Center campus for a comparable cost, but will not be analyzed at this time.

The existing Goodall Lodge, as well as a new building listed in the narrative below, will utilize a VRF, Variable Refrigerant Flow, system to provide heating and cooling to individual zones. VRF uses refrigerant as the cooling and heating medium, and allows one outdoor condensing unit to be connected to multiple indoor fan-coil units (FCUs), each individually controllable by its user, while modulating the amount of refrigerant being sent to each evaporator. By operating at varying speeds, VRF units work only at the needed rate allowing for substantial energy savings at partial-load conditions. Heat recovery VRF technology allows individual indoor units to heat or cool as required, while the compressor load benefits from the internal heat recovery. The indoor fan coil units can either be ducted system or ductless systems where the fan coil simply is mounted to the wall.
MECHANICAL ASSESSMENT

1. KILLFISH CABIN

EXISTING:
(870 sf) Six single through-wall AC Unit with Electric Heat

RECOMMENDATION:
Replace with 1.5 Ton Mitsubishi Ductless Mini-split system.

COST:
$5,000

2. LUBBER LAB

EXISTING:
(2,145 sf) Two 3-Ton AC units with Propane heat

RECOMMENDATION:
Replace with 3.5 Ton Mitsubishi Ductless Mini-split system.

COST:
$7,000

3. SWALLOW BARN

EXISTING:
(825 sf) Central AC with electric heat strips

RECOMMENDATION:
Replace with 1.5 Ton Mitsubishi Ductless Mini-split system.

COST:
$5,000
MECHANICAL ASSESSMENT

4. MIDGE HOUSE

EXISTING:
(1,170 sf) Three-bedroom central AC Unit with Heat Pump

RECOMMENDATION:
Replace with 2.0 Ton Mitsubishi Ductless Mini-split system.

COST:
$6,000

5. PRICKLY PEAR

EXISTING:
(1,560 sf) Six single through-wall AC units with electric heat

RECOMMENDATION:
Replace with 2.5 Ton Mitsubishi Ductless Mini-split system.

COST:
$7,000

6. PENSTEMON

EXISTING:
(400 sf) Through-wall AC unit with electric strip heat

RECOMMENDATION:
Replace with 1.0 Ton Mitsubishi Ductless Mini-split system.

COST:
$3,000
MECHANICAL ASSESSMENT

9. BLUESTEM

EXISTING:
(900 sf) Three-bedroom central AC Unit with Heat Pump

RECOMMENDATION:
Replace with 1.5 Ton Mitsubishi Ductless Mini-split system.

COST:
$4,000

10. LOCUST

EXISTING:
(700 sf) Through-wall AC unit with wood heat

RECOMMENDATION:
Replace with 1.0 Ton Mitsubishi Ductless Mini-split system.

COST:
$3,000

12. GAINSFORTH LODGE

EXISTING:
(4,950 sf (2 levels = 9,900 sf total)) Three zoned heat pumps (3-Ton each) with exchanger for both AC and heat.

RECOMMENDATION:
Replace with 16.5 Ton Mitsubishi Ductless Mini-split system.

COST:
$32,000
MECHANICAL NARRATIVE

Existing Goodall Lodge

The existing building has a through-wall AC unit for the kitchen and two through-wall AC units for the basement. There is currently no heat in Goodall Lodge.

The existing building will receive a VRF system with multiple wall mounted ductless fan coil units throughout the building. Residential type room exhaust fans will serve the restrooms. The VRF system will provide heating and cooling capabilities to Goodall Lodge. A central BMCS connection will not be required for this building.
MECHANICAL NARRATIVE

New Classroom / Lab space

The new classroom/lab building would utilize a combination of a VRF system paired with an energy recovery ventilator (ERV). The ERV will contain a heat recovery wheel that transfers energy from the exhaust air stream to pre-treat the outdoor air. It will also contain an exhaust fan, and outdoor air fan, a DX cooling coil, a propane-fired indirect heater, and a prefilter bank in the outdoor air path. The exhaust air will be fully ducted from all bathrooms and miscellaneous spaces within the building. A VRF system will serve all spaces in the building, with multiple above ceiling fan coil units connected to each outdoor condenser unit. Outdoor air will be ducted to each indoor fan coil unit. A central BMCS will be installed for the new building.

An additional water well with pump and new septic tank will be required for the new classroom/lab space. New domestic cold and hot water piping and sanitary piping will be required. A new propane water heater will serve the new building, supplied by a new above ground propane tank.
A geothermal system has a high initial cost and will require a much more extensive campus installation. The following analysis makes several assumptions in order to calculate a payback period by replacing the current equipment. It should also be noted that the capital cost listed below is only applicable if all vertical wells are bored during the same time frame. If the boring of vertical wells are scheduled as funding becomes more readily available, the capital cost will be higher, due to the cost of bringing the boring equipment to the site and setting it up multiple times. It was assumed that current HVAC equipment consumes two-thirds of the total electrical load on the campus, which equates to about $10,000 per year of HVAC electrical costs. Geothermal modeling software predicted the annual electrical consumption of a new geothermal system to be about 28,000 kWh per year. Assuming a cost of $0.065/kWh, the total yearly energy cost of a new geothermal system would be approximately $2,500. This leads to HVAC electrical savings of approximately $7,500 per year.

**APPROXIMATE CAPITAL COST:**

34 VERTICAL WELLS X $4,000/WELL = $136,000
HEAT PUMPS = $50,000
TOTAL CAPITAL COST = $186,000

**YEARLY SAVINGS** = $7,500

**SIMPLE PAYBACK PERIOD** = 24.8 YEARS

*For comparative purposes, the calculated payback of the ductless mini-split system is 14.7 years.*
BUILDING ENERGY IMPROVEMENTS

BUDGET COST ESTIMATIONS

1. KILLIFISH CABIN
   870 SF x $13.62/SF = $11,850

2. LUBBER LAB
   2,145 SF x $10.48/SF = $22,480

3. SNA WALLOWBARN
   825 SF x $12.78/SF = $10,540

4. MIDGE HOUSE
   1,170 SF x $11.56/SF = $13,530

5. PRICKLY PEAR
   1,560 SF x $10.76/SF = $16,790

6. PEN STAMON
   400 SF x $14.58/SF = $5,830

9. BLUESTEM
   900 SF x $10.71/SF = $9,640

10. LOCUST
    700 SF x $10.50/SF = $7,350

12. GAINSFORTH LODGE
    9,900 SF x $16.78/SF = $166,090
BUDGET COST ESTIMATIONS

1. SITE IMPROVEMENTS (PAGE 31)
   $930,380.00

2. GOODALL LODGE IMPROVEMENTS (PAGE 40)
   $2,642,280.00

3. CAMPUS ENERGY IMPROVEMENTS (PAGE 57)
   $264,100.00

ADDED ITEMS:
General Conditions, Overhead, Profit, Insurance, Bond (15%)
Design Contingency (5%)
Escalation (5%)

PROJECT CONSTRUCTION TOTALS:
$3,836,760.00
HDR RECOMMENDATIONS

The cost estimates found within the visioning master plan are to be used only for budgetary purposes. The total budget cost estimates for completing all aspects of the project would equate to nearly $4 million (page 58). With the current project construction budget set at $400,000 – $450,000, choices will need to be made by the university as to how to allocate funding. HDR offers the following recommendations:

SITE IMPROVEMENTS
It is HDR’s recommendation that site issues concerning access roads, walking paths, and site drainage be addressed immediately within the current project scope. High priced items, such as the replacement of the bridge or the new construction of concrete ADA ramps might need to be separated and delayed as alternates until adequate funding is reached.

GOODALL LODGE
The initial cost of renovating or replacing Goodall Lodge is so high that it is most likely out of budget for the near future. These options should be kept as part of the master planning conversation as fundraising and grants progress for the CPBS. The addition of an outdoor classroom pavilion (page 37) appears to be the feasible alternative for acquiring additional educational space in the current project budget. HDR recommends completing immediate deferred maintenance for the building including roof replacement and exterior access improvements. HDR also recommends the construction of the new outdoor pavilion to increase functional, educational space.

ENERGY SYSTEMS
The initial cost of alternative energy systems such as wind energy, solar power, and geothermal systems are very high and most likely outside the bounds of the current budget. Therefore, HDR recommends the replacement of antiquated HVAC systems with high efficiency systems for the present project. As mentioned in the assessment of Goodall Lodge, the alternative energy systems should be kept in the conversation for fundraising and outlook for future master planning.
**IMAGE SOURCES**

Pg 9, Fig.1: (SANDSTONE RETAINING WALL) http://123databaseimages.com/sandstone+rock+wall?image=1059953192

Pg 11, Fig.1: (RURAL STUDIO BRIDGE) http://www.ruralstudio.org/projects/perry-lakes-park-covered-bridge

Pg 11, Fig.2: (CULVERT) https://www.downeastlakes.org/aquatic-habitat-restoration-on-the-community-forest/

Pg 15, Fig.2: (PERMATRACK) http://www.permatrak.com/permatrak-photo-gallery

Pg 16, Fig.2: (GABION WALL) http://www.gabion1.com.au/gabion_pic_info12.htm

Pg 22, Fig.1: (GOODALL LODGE SOCIAL AREA OVERLOOK) http://www.houzz.com/projects/2726/farm-field-pacific-rim

Pg 22, Fig.2: (TREEFOIL RANCH GIRL SCOUT CAMP) http://www.houzz.com/projects/2726/farm-field-pacific-rim

Pg 23, Fig.2: (SUREGREEN PAVERS) http://www.groundprotection.co.uk/grid-panel/images/bigs/suregreen-paver-c.jpg

Pg 47: (SOLAR ENERGY) http://prakashrayinfra.com/solar.html
APPENDIX

APPENDIX 1: A GUIDE TO PRAIRIE AND WETLAND RESTORATION IN EASTERN NEBRASKA

APPENDIX 2: GOODALL LODGE ACCESSMENT

APPENDIX 3: BUDGET ESTIMATE: CEDAR POINT BIOLOGICAL STATION

APPENDIX 4: ENERGY SYSTEMS SPECIFICATION SHEETS