Oregon Zoo Bond
Citizens' Oversight Committee

Skyline Room, Oregon Zoo
Wednesday, May 9, 2018
3 to 5 p.m.

Oregon Zoo Bond Citizens' Oversight Committee Meeting
May 9, 2018
Agenda

AGENDA

ITEM	ACTION	ANNUAL REPORT	LEAD	TIME
A. Welcome / Introductions • Agenda overview • New member introductions	Review		Susan Hartnett	3:00
B. Oversight Committee annual report – review of presentation to the Metro Council April 12, 2018	Discuss		Susan Hartnett	3:15
C. Minutes of Feb. 14, 2018, Committee meeting	Approve		Susan Hartnett	3:25
D. Monthly Project Status Reports 1. Education Center 2. Polar Passage/Primate Forest/Rhino a. Final Design b. Lease Crutcher Lewis Diversity in Workforce and Contracting Plan c. Rhino habitat switch in funding source 3. Interpretive Experience – No report 4. Percent-for-Art 5. Electrical Infrastructure 6. Close-out project: Tree mitigation – No report	Discuss	Page 28, 34 Page 24, 45, 48 Page 20, 24	Heidi Rahn, Jim Mitchell	3:30
E. Program Status and Financial Information at a Glance • Bond sale	Discuss	Page 48	Heidi Rahn	3:55
F. Program and Projects Schedule	Discuss		Heidi Rahn	4:00
G. Elephant Welfare Study Results – How Elephant Lands enhances elephant welfare	Discuss	Page 38	Nadja Wielebknowski, Sharon Glaeser	4:05
H. Elephant Lands Operating Outcomes report	Discuss	Page 50	Don Moore	4:25
I. Zoo and Oregon Zoo Foundation Update	Update		Don Moore, Julie Fitzgerald	4:40
J. Open Discussion/Questions	Discuss		Susan Hartnett	4:55

Upcoming 2018 and 2019 meeting dates –Wednesdays, 3 to 5 p.m.:

Sept. 12, 2018 Conservation Hall, Education Center, Oregon Zoo
Nov. 14, 2018 Conservation Hall, Education Center, Oregon Zoo (note new room location)

Feb. 13, 2019 Conservation Hall, Education Center, Oregon Zoo
May 8, 2019 Conservation Hall, Education Center, Oregon Zoo
Sept. 11, 2019 Conservation Hall, Education Center, Oregon Zoo
Nov. 13, 2019 Conservation Hall, Education Center, Oregon Zoo

Oregon Zoo Bond Citizens' Oversight Committee Meeting

May 9, 2018

Agenda item C

Oregon Zoo Bond
Citizens' Oversight Committee

Oregon Zoo – Conservation Hall
Wednesday, Feb. 14, 2018
3 to 5 p.m.

MINUTES

MEMBERS PRESENT	AFFILIATION
Ruth Shelly (Chair)	Portland Children's Museum
Dan Aja	Banfield Pet Hospital
Noah Bishop	Bishop Bankruptcy Law, LLC
Heidi Goertzen	Ferguson Wellman Capital Management
Susan Hartnett (Vice Chair)	Spectator Venues, City of Portland
Mickey Lee	NW Natural
Jill Mellen	Research Biologist
Daniel S. Morris	Daniel Morris Research, LLC
Katherine A. Porras	Meyer Memorial Trust
Kevin Spellman	Spellman Consulting, Inc.
Dick Stenson	Retired healthcare executive; community volunteer

MEMBERS ABSENT	AFFILIATION
Deborah Herron	Walmart
Robyn K. Pierce	Pierce, Bonyhadi & Associates
Christi L. Taylor	Miller Nash Graham & Dunn
Karen Weylandt	Providence Health & Services

GUESTS	AFFILIATION
Javier Mena	Portland Housing Bureau, City of Portland
Ana Muñoz	Latino Network, Schools Based Program
Emma Stocker	Portland State University, Emergency Management

ELECTED OFFICIALS AND STAFF	
Shirley Craddick	Metro Councilor
Scott Cruickshank	General Manager, Metro Visitor Venues
Julie Fitzgerald	Oregon Zoo Foundation Executive Director
Caleb Ford	Metro Assistant Finance Director
Kate Giraud	Oregon Zoo Bond Assistant Project Manager
Sheri Horiszny	Oregon Zoo Deputy Director of Living Collections
Jim Mitchell	Oregon Zoo Bond Construction Manager
Joel Morton	Metro Senior Attorney
Linnea Nelson	Oregon Zoo Bond Program Coordinator
Heidi Rahn	Oregon Zoo Bond Program Director
Scott Robinson	Metro Deputy Chief Operating Officer
Marcia Sinclair	Oregon Zoo Marketing
Wayne Starkey	Oregon Zoo Bond Project Engineer

A. Welcome / Introduction

Ruth Shelly, Oregon Zoo Bond Citizens' Oversight Committee Chair, opened the meeting at 3:05 p.m., and members and guests introduced themselves. Three guests attended who are potential candidates to become new Oversight Committee members.

Heidi Rahn thanked members who had made candidate referrals for the current recruitment for new committee members. Staff has been recruiting for three weeks, and referrals are due today. Two members retired last fall, and four more members' terms will expire in May: Noah Bishop, Deborah Herron, Mickey Lee and Daniel Morris have generously agreed to serve through the next Oversight Committee meeting on May 9, 2018. New members are scheduled to start after that meeting. This meeting is Chair Shelly's last meeting to serve as chair, but she will continue to serve as chair until Susan Hartnett is appointed as the new chair by the Metro Council in April. Chair Shelly has graciously agreed to stay on as past chair through the end of 2018, to assist with the transition.

Chair Shelly and bond program director Heidi Rahn acknowledged Scott Robinson, former Metro deputy chief operating officer who is retiring in mid-March. They spoke about his leadership in establishing and directing the zoo bond program, and his dedicated service over 10 years that helped ensure its success. He helped navigate the land use process to receive city approvals without any delays to construction. Under his tenure, the program spent $102 million and finished all projects to date on time and on budget.

Since December 2017, the zoo bond program has reported to Scott Cruickshank, Metro general manager of visitor venues, who also oversees the rest of the zoo.

B. Approval of Nov. 8, 2017, Oversight Committee meeting minutes

Members approved the minutes of the Nov. 8, 2017, Oregon Zoo Bond Citizens' Oversight Committee ("Oversight Committee" or "the Committee") meeting.

C. Monthly Project Updates

1. **Education Center** –Heidi Rahn reviewed the Education Center highlights. The center has to operate for a full year to get net zero energy operations results. In January, the center received the Engineering Excellence 2018 Grand Award from the American Council of Engineering Companies.

2. **Polar Passage/Primate Forest/Rhino** – Construction manager Jim Mitchell provided an update. Staff received the 100 percent design development cost estimate from Lease Crutcher Lewis (LCL), the construction management by general contractor (CM/GC) firm, and an estimating company hired by the architect. The project is an estimated $6 million (direct costs) over the construction budget of $33 million. The design team is working at simplifying the building design to reduce cost without taking away from programs that the zoo keepers need to care for the animals. The team held a value engineering session at the last design workshop earlier in February; a budget option log is being developed to confirm cost reductions with stakeholders. The value engineering ideas that will be included in the budget option log will get the projects close to budget. The budget option log will be presented to the project stakeholders. The bond team is now waiting for reconciliation between two estimators. Mr. Mitchell commented on the high construction costs. He has been in this business for 40 years, and has never seen anything like what he sees in the market today. It is hard to get interest from subcontractors to provide estimates to the general contractor. LCL queried 70 subcontractors for estimates, and only got responses from seven. It is an unusual market, with

the subs booked for one year, instead of four to eight months. Mr. Mitchell thinks it will be difficult to get three estimates on each scope for this project, as required by the contract.

The zoo is a difficult place for contractors to work, due to the need to park elsewhere and shuttle in, the daily retail operation, tight quarters, animal welfare concerns, etc. Nothing about the project is standard, with animal caging, and lots of specialized concrete that needs to be insulated for animals. The COBID[1] market place is in high demand, so staff is concerned about meeting its COBID goal of 15 percent utilization.

Staff is working on an early work package that will be for demolition and civil work, with bids due May 1 and construction scheduled to start June 4. Next week the team plans to submit its building permit application for the early work package. The construction schedule may be a little aggressive since the city will not give indication of when it will approve the main permit. The main project is planned to be submitted for permits in May. Main project construction is planned to start in September or October.

The project is within the budget, and the CM/GC has included construction escalation and a design and estimating contingency. The cost of steel and concrete has escalated, as well as other materials. The CM/GC's design and estimating contingency will be allocated to the project scope as design is finalized and construction starts, and the construction escalation will drop off as well. Unspent escalation and contingency will go back into the project budget. The owner's contingency is for unknowns on the zoo site, such as the many buried remains of former structures, and other items that may arise.

Metro assistant finance director Caleb Ford responded to a question regarding potential bond arbitrage costs due to the construction schedule. Metro has the authorization to spend the bond money, contracts are in place and the money is scheduled to be spent, so it is unlikely the program will have an arbitrage issue and need to pay additional costs to the IRS.

Kevin Spellman commented that Portland Public Schools is suffering the same construction cost escalation experience. Some of the 2017 projects are in early design, and are coming back in tens of millions of dollars over budget. Everyone in the industry is so nervous that there is a compounding of fear factor that drives up prices.

The bond team considered waiting, but doesn't see the prices going down soon, so has to stride forward. Chair Shelly observed that it was fortunate that the program started in 2008 when prices were lower.

LCL is working on its Diversity in Workforce and Contracting plan, which staff will share with the committee when it is ready. They continue to do a ton of outreach to the COBID community. A list of some of that outreach was included with the January Zoo Bond Equity in Contracting Quarterly Report, and duplicated in the meeting packet. It is likely LCL will have a female project manager who has made a commitment to make sure that every woman on site is personally welcomed and supported. Sarah Jimenez is one of LCL's project engineers on the project, and was previously an

[1] Metro's Equity in Contracting Program encourages the use of minority-owned businesses (MBE), woman-owned businesses (WBE), service-disabled veteran-owned businesses (SDV), and emerging small businesses (ESB), as defined under State law in ORS Chapter 200 and as certified by the Certification Office of Business Inclusion and Diversity (referred to as COBID-certified businesses) to the maximum extent practical.

intern with LCL on the Elephant Lands project. This is one example of LCL's mentoring program and commitment to diversity.

Members asked about the removal of the maternity den from the Polar Passage design. Staff explained that from a needs perspective, keepers felt that it was not the highest priority at this time, and they would not breed polar bears in the near future. Zoo deputy director of Living Collections Sheri Horiszny explained that so much is not known about the wild population of polar bears. The zoo did not want to invest a lot of money in building a polar bear maternity den and then be asked not to breed. So the bond team plans to leave the space in the design and defer construction to a later date, as needed. Ms. Horiszny said that her staff looked at what was needed now, and what space could be reserved for later needs. They will get done what they can afford and what meets the ballot measure promises.

Members asked about other critical items that may have been removed. Ms. Rahn said that Elephant Lands went through the same value engineering process, and still produced a word-class habitat. So staff feels they can bring this project into budget, and utilize the program unallocated contingency for other projects and needs.

Councilor Shirley Craddick asked about how the zoo will get polar bears, due to the endangered species restrictions. Ms. Horiszny explained that the zoo and its partners are working to get a research permit for zoos in the US, which would allow polar bears to come from Canada, where many bears are coming out of the wild. Zoo director Don Moore and she have been working on it for some time, and will continue to work to have the Oregon Zoo positioned to receive bears.

Noah Bishop said he felt like the budget in the Polar Passage project monthly report should be on "caution" at this point, so the Committee recognizes the status. Staff agreed that if it is not within budget for the next month's report, it will then be shown as "caution." Mr. Bishop added that he also feels it is best to keep the unallocated program contingency for future needs.

Mr. Mitchell explained that the team is in the design process now, and if they get the budget in line, he does not think the budget should be shown as "caution" (in yellow). He sees the caution indicator more for when the project is under construction and costs are over budget. Transparency of reporting is important.

Scott Robinson indicated that if they do not make value engineering this round, then they will have to show yellow (caution) on the schedule, because that is what will be impacted, and that could affect cost increases.

3. **Interpretive Experience** – No new report.

4. **Percent-for-Art** – The Polar Passage artist team of Edwin and Veronica Dam de Nogales is working on fabricating the sculptures, and is documenting the fabrication process with videos. In December 2017, staff delivered a summary of public art expenditures to date that showed that the bond program is on track to meet its 1 percent for art expenditures requirement (based on direct construction costs).

5. **Electrical Infrastructure** – The zoo received bids for replacing two electrical generators, but they were over budget, so is going back out to bid with a refined scope of work. The zoo is reevaluating

the planned partnership with Portland General Electric for Dispatchable Service Generation, and may need to remove that from the scope due to the budget constraints. The high bids are also evidence of the current construction market conditions and cost escalation.

D. Program Status and Financial Information at a Glance

The unallocated program contingency is up to $2.3 million, due to the Council reallocation in 2017. Caleb Ford spoke about the final zoo bond sale of $10 million, which is planned for May 1, 2018, and is expected to close two weeks later. It will be combined with the Metro Natural Areas bond sale. Changes in the tax law now are causing a lot of turmoil in the market. The outcome of the sale will be known at the next committee meeting on May 9.

E. Program Schedules

The Polar Passage/Primate Forest/Rhino project construction is still planned for May/June 2018, but the schedule will be updated when staff gets the new phasing plan. The bond program still plans to wrap up in 2020, and is proceeding with caution, for now.

F. Committee Annual Report draft review

The committee's annual report covers the bond program activities for the calendar year 2017, and is scheduled to be presented to the Metro Council on April 12, 2018, by Chair Shelly and Vice Chair Susan Hartnett. Two subcommittees prepared the report draft for the full committee to review, and Chair Shelly thanked them. The Finances Subcommittee was chaired by Heidi Goertzen and assisted by Katherine Porras and Noah Bishop. The Projects Progress Subcommittee was chaired by Susan Hartnett, and assisted by Mickey Lee and Kevin Spellman. Chair Shelly combined and edited the entire draft, and will prepare an introductory letter for the report. The draft is still a work in progress, and final copy proof editing and formatting will be done later by staff. Chair Shelly asked members to focus on the recommendations. Members reviewed the draft recommendations and suggested edits.

Mickey Lee noted that there has been a big shift to looking at workforce diversity, and not just COBID utilization. She commends the staff and committee for focusing on workforce diversity. Mr. Mitchell talked to LCL about having contractors show workforce diversity by filling out a form, and they are trying a new method to better track workforce diversity. Ms. Rahn said that the zoo bond program is now hitting the COBID utilization minimum target of 15 percent, but she is not confident the program will by the end, given the constraints in the final project and limited availability of COBID-certified firms. By focusing on workforce diversity, particularly through its Construction Careers Pathways Project (C2P2), Metro is helping to build the future construction workforce supply. Chair Shelly noted that the Committee had just heard of a previous minority contractor intern that has returned as a full engineer, so Metro's efforts are working.

Regarding the Percent for Art solicitation process, the Committee asked for more information from the Oregon Zoo Public Art Advisory Committee, and Susan Hartnett agreed to contact Chair Kregg Hanson and the Regional Arts and Culture Council. Members suggested that the zoo document the role, process and value of OZPAAC, which has been a successful committee. As a result of the bond investment, the zoo has stepped up its assessment and management of its artwork, which is an ongoing benefit.

Ms. Rahn indicated that she anticipates providing the final results of the elephant welfare study at Elephant Lands at the next meeting. Members congratulated the zoo on the improvements to

elephant welfare, and suggested including that in the report cover letter and early in the report project section.

Members asked that the zoo's Integrated Conservation Action Plan (ICAP) be appropriately referenced in the report. Ms. Horiszny gave a brief update on the draft plan. Zoo staff are working on four different ICAP areas, and each has a planning team working on developing a planning framework. The project has a lot of staff involvement, and lots of feedback. The zoo formed an ICAP steering committee to ensure that it will live on over time. The zoo is definitely making progress, but has not indentified a date when it will be done. It is a living plan that will change over time, but a formal adoption date will be set. The proposal is to have it adopted as an official document. The zoo will try to follow it for five years. Everyone will be able to see priority areas and make decisions from it, and it will inform strategic planning.

Members talked about wanting bond projects to be looked at periodically after they are up and running to see if they are working as intended. The zoo needs to continue regular maintenance on bond projects so that they are operational, and plan for those associated costs.

Chair Shelly commended the report work groups and all members for their edits. She will go through the report again and write a cover letter, and make sure all edits are incorporated. One of the themes will be the request to make sure projects are operating as intended, and to document the successful bond processes for the future. Members will have one more chance to go through the report again.

Members discussed the length of the document (57 pages), and suggested that next year they look at reducing the size, to make it as concise as possible and more readable. Ms. Hartnett will be chair of the committee next year and will tackle looking at how to best do the reporting as the bond program winds down. In future reports, they want to zero in on key messages that still supply value. Of course, since it is a cumulative report, it grows with time. They want the report to still be thorough, but they also want people to read it.

G. Zoo Update

Sheri Horiszny, Oregon Zoo deputy director of Living Collections, gave an update and presentation (a copy of which is included with the record) on construction proactivity – what the zoo is doing to prepare for the upcoming construction starting this spring of Polar Passage/Primate Forest/Rhino that will affect a major portion of the center of the zoo campus. Twenty-one planning teams of zoo staff are participating, led by zoo Facilities. The goal is to provide excellent guest experiences during construction. In preparation, staff, animals and materials are being relocated, and staff are looking at financial impacts, safety and operations. They are also looking for wildlife, including birds, and encouraging them to go elsewhere in a way that is beneficial for their welfare, so they are not impacted by construction. Staff have been using an acoustic system of predator noises to deter birds from building nests and laying eggs, and staff conduct weekly walks looking for the beginnings of nests in the areas that will be impacted by construction

To provide a richer guest experience, the zoo is trying to put new animals on exhibit, such as the porcupine and sloth, and offering paid and unpaid animal encounters. The zoo is also planning to offer more keeper talks than normal, and more demos and shows, such as the zoo's summer animal show that is also planned to be offered at other times of the year. Visitors will have opportunities to pay to have a closer encounter with animals. For example, they may be able to see the goat kids for

$10 per person, providing a fun, immersive experience. Other planned encounter opportunities include sea otters, prehensile-tail porcupine, tortoise and insects in the Insect Zoo. Phase two will include aardvark, lions, elephants and others. These encounters create alternative animal experiences for people. When visitors have a live person present with an animal, giving a presentation, then the visitors ask more questions and have more engagement. The zoo is looking at other ways to reach out to visitors, helping them to notice more areas of the zoo that are not under construction.

The zoo is working on creating a giraffe feeding area platform that will put visitors face-to face with giraffes, to feed them. The platform may possibly open in June, but giraffes may not be there until July, since it takes them time to adapt to a new environment. Ms. Horiszny has experience with such a feeding station at the Santa Barbara Zoo where she previously worked. Buttercup, one of the Oregon Zoo's giraffes, is offspring of a giraffe at the Santa Barbara Zoo that generates a quarter million dollars per year at the feeding station in Santa Barbara.

Since BearWalk Café will be demolished during construction, the zoo is talking about having several food trucks instead. The zoo has experimented with food trucks for events, and it has been working well. The bond team will work to get the new café opened as soon as possible, but the BearWalk Café will be closed at least a year and a half. Other zoo food service areas, such as the Cascade Grill and AfriCafé, will remain open. The zoo is now doing a refresh of AfriCafé in preparation for the construction period and closing of BearWalk Café.

Visitors will have access to get around the construction areas, and the zoo will make it interesting, with holes in the construction fences to peak in, a playful guide to construction equipment, etc.

During construction, orangutans will go to the Veterinary Medical Center, and the chimps will move to the orangutan habitat, modified for them. In the VMC, the orangutans can enjoy the retractable roof in some of the animal areas. In total, the zoo has sent out 42 animals, representing 14 species in preparation for construction.

Councilor Shirley Craddick asked about plans to create a story of this moving process for the public, since she thinks there would be interest. Zoo Marketing is looking at project milestones and storytelling.

Ms. Rahn thanked the Committee for its excellent report, noting that it is the Committee's report and not a staff report. She also thanked Chair Shelly for her leadership and acknowledged that this was her last meeting to chair. Members also thanked Chair Shelly for being a great facilitator and leader, and for guiding the Committee through the report draft so quickly.

H. Adjournment

Chair Shelly adjourned the meeting at 4:51p.m.

Upcoming 2018 meeting dates –Wednesdays, 3 to 5 p.m.:

May 9, 2018 Conservation Hall, Education Center, Oregon Zoo
Sept. 12, 2018 Conservation Hall, Education Center, Oregon Zoo
Nov. 14, 2018 Conservation Hall, Education Center, Oregon Zoo

Oregon Zoo Bond Citizens' Oversight Committee Meeting

May 9, 2018

Agenda item D

Oregon Zoo Bond Citizens' Oversight Committee meeting

May 9, 2018

Agenda Item D. Monthly Project Status Reports

1. Education Center
2. Polar Passage/Primate Forest/Rhino
3. Interpretive Experience – No report
4. Percent-for-Art
5. Electrical Infrastructure
6. Close-out project: Tree mitigation – No report

Oregon Zoo Bond Project Status Report
Education Center

Oregon Zoo Bond Citizens' Oversight Committee Meeting
May 9, 2018
Agenda item D-1

Project Title: Zoo Education Center	**Project Manager:** Kate Giraud
Reporting Period #055/Status Date: April 27, 2018	**Project Manager Phone:** 503-548-2677
Architect/Engineering Design Consultant: Opsis Architecture	**Construction Manager/General Contractor:** Fortis Construction

Project Description: The zoo Education Center will be located at the site of the original zoo entrance. It will provide flexible and engaging education program activity spaces for camps, classes, and zoo visitor and program partner use. In addition to the education programming at the Center, the project includes visitor comfort amenities identified for the "West Hub" in the Comprehensive Capital Master Plan, including but not limited to: train ticket sales, restrooms, wayfinding/trip-planning material, seating and food. Finally, this project includes a portion of infrastructure improvement work, identified in the Master Plan, to address storm water and aging site utilities.

Status at a Glance

Status Item	On Track	Caution	Off-track
Budget	X		
Schedule and signoffs	X		
Deliverables	X		

LEGEND:

	Moving along nicely, no significant concerns at this time.
	Must be addressed or may be escalated to off-track mode.
	Causing significant impact to the project.

Design and Construction Schedule

Start Date		Completion Date	
Estimated	Contract	Estimated	Substantial Completion
4/21/14	6/25/14	1/3/17	12/28/16

Project Budget and Expenditures

Original Baseline	Revised Baseline	Costs to Date Of Status	Estimate at Completion	Estimated Budget Variance
$12,899,510	$17,699,157*	$17,401,294	$17,482,791	($216,366)

*** The Education Center budget was updated in December 2017 with all allocated resources. In April 2016 the budget was updated with funding from unallocated bond contingency (authorized by Metro Council) for add-alternate list and net-zero solar energy, plus additional funding for south entry storm pipe construction (co-funded with City of Portland), Metro Resource Conservation and Recycling funds for the Wildlife Garden construction, and previous bond project savings reinvested to meet state solar requirements and security infrastructure.**

Critical Issues

None at this time.

Summary Status

Milestones/deliverables/information for this reporting period:

- The programming of the energy dashboard in the Nature Exploration Station (Education Center) has been completed, and the screen will be live soon for interactive visitor use.
- Contractors are working on the final task of programming the digital controls.

Planned milestones/deliverables/information for the next reporting period:

- Completion of the digital control programming and contract close-out tasks.

Oregon Zoo Bond Project Status Report
Polar Passage/Primate Forest/Rhino

Oregon Zoo Bond Citizens' Oversight Committee Meeting

May 9, 2018

Agenda item D-2

Project Title: Polar Passage/Primate Forest/Rhino	**Project Manager:** Jim Mitchell
Reporting Period #028/Status Date: April 26, 2018	**Project Manager Phone:** 503-914-6025
Architect/Engineering Design Consultant: CLR Design	**Construction Manager/General Contractor:** Lease Crutcher Lewis (LCL)

Polar Passage Project Description: The new polar bear habitat is needed to increase access to natural substrate; increase the efficiency of the water-filtration system; reduce temperatures; chill the pool water; and increase both land and pool space. Construct modern natural holding areas with better lighting and ventilation, allowing better care for the animals. Space requirements, water quality and housing conditions will meet or exceed the Manitoba Protocols established for zoo polar bears. New utilities will complete the system upgrade installed with previous bond-funded projects. Guest services will be enhanced at the new central plaza.

Primate Forest/Rhino Project Description: The current schematic design demolishes the existing building (except for the newer Red Ape Reserve) and rebuilds on the current primate site for chimpanzees. Orangutans will live in the existing Red Ape Reserve. The Metro Council approved the project scope modifications on March 16, 2017. Rhino habitat: Remove the hippo dump-and-fill pool, remove the barrier between the rhino/hippo habitats and re-grade both habitats for rhino use only.

Status at a Glance

Status Item	On Track	Caution	Off-track
Budget	X		
Schedule and signoffs		X	
Deliverables	X		

LEGEND:

	Moving along nicely, no significant concerns at this time.
	Must be addressed or may be escalated to off-track mode.
	Causing significant impact to the project.

Design and Construction Schedule

Start Date		Completion Date	
Estimated	Contract	Estimated	Substantial Completion
05/2016	6/2016	06/2020	TBD

Project Budget and Expenditures

Original Baseline	Revised Baseline	Costs to Date of Status	Estimate at Completion	Estimated Budget Variance
$34,348,074	$43,802,256*	$2,546,798	$43,802,256	$0

***On Feb. 4, 2016, the Metro Council approved the bond team's recommendation to increase the Polar Passage project budget by $2.6 million to cover escalation costs exceeding the original estimated escalation.**

On March 16, 2017, the Metro Council approved additional bond fund resources increasing the Polar Passage project budget by $3,248,334 ($2,200,000 from OZF and 1,048,334 from the program contingency) and increased the Primate Forest/Rhino project budget by $2,605,848 to offset escalation costs.

On April 6, 2017, the Metro Council approved an exemption to competitive procurement by combining Polar Passage and Primate/Rhino projects under the existing design and Construction Management/General Contractor contracts to save an estimated $1.3 million in construction costs. Project budgets and schedules have been combined.

In August 2017, the Nancy Parr estate donation of $237,333 for Primate Forest was added to the project budget.

On October 5, 2017, OZF approved $750,000 (including the $237,333 Nancy Parr estate donation) for Primate Forest and $250,000 for Rhino.

On April 5, 2018, OZF approved redirecting $500,000 previously committed for Polar Passage maternity den (which will not be built in this phase) to fund the rhino habitat project in total, $750,000. Bond funds previously allocated for the rhino project will be redirected to the Polar Passage project.

Critical Issues:

Schedule: The construction schedule in Status at a Glance is showing a caution due to the following:

- Unknown timeline related to permit review on the main project. Recent estimates are six to seven months; the construction schedule is showing five months.
- One month delay in starting the value engineering process due to prolonged estimate reconciliation, illnesses of key estimate staff, key staff car accident and spring break vacations.
- Potential requirement to submit a Type II Amendment to the city for the zoo's land use permit. This process is estimated to take seven to nine months. The amendment may be required due to a variation in sequence and design to the zoo's Conditional Use Master Plan. The variation includes adding a café, demolishing the existing primate building and constructing a new primate building in a different location from what is shown on the land use Master Plan.
- Staff will meet with the city to demonstrate that the existing design is in compliance with the zoo Conditional Use Master Plan.
- The city has estimated the permit review timeline for the early work package, which involves demolition and rough grading, to be three months. The items listed above should not impact approval of this permit.

Summary Status:

Milestones/deliverables/information items for this reporting period:

- Detailed drawings and an explanatory statement regarding confirmation that the design is in compliance with the Conditional Use Master Plan was submitted to the City on April 13. A response is pending.
- The 25 percent construction document review in design workshop #12, was held April 24 to 26. The workshop focused on validating value-engineered scopes, locking in the building and site design, and starting the more detailed design phase.
- The city has been responsive in the early work package permit review; zoo bond staff are receiving checksheets on the drawings submitted.
- Lease Crutcher Lewis has submitted its Diversity in Workforce and Contracting Plan.

Planned milestones/deliverables/information for the next reporting period:

- Subcontract bids for the early work package are due May 1.
- The early work package includes five scopes of work that are $35,000 or less. LCL plans to contact three COBID firms for quotes on each scope and direct award to the lowest COBID bidder.

Construction progress:

- Construction on the early work package is scheduled to start in June 2018. The main project is scheduled to start in the fall.

LEASE CRUTCHER lewis

550 SW 12th Avenue
Portland, OR 97205

T: 503.223.0500
F: 503.223.2874

lewisbuilds.com

Oregon Zoo Bond Citizens' Oversight Committee Meeting

May 9, 2018

Agenda item D-2b

Oregon Zoo

Polar Passage/Primate Forest/Rhino

Diversity in Workforce and Contracting Plan

April 25, 2018

Lewis is a champion for diversity and equity in the community. We strive to create a vibrant, inclusive culture where diversity of thought sparks innovation. We seek to cultivate lasting relationships with diverse and emerging trade partners, based on a foundation of Trust and Respect.

In the following pages, we have assembled an outline of the major sections of our Contracting Plan. They include Outreach, General Bidding, On-the-job training, Partnerships, Mentoring, and Technical Assistance. In each of the sections we have included our sample forms and metrics that we will use to track and ensure a consistent process.

In an effort to maintain coordination of design, while balancing the goals of the project including safety, best value, diversity/inclusion and local participation, it is our intent to assemble the bidding for this project in 2 phases. An outline of our contracting strategy, as well as our approach to outreach is included in the following pages, with a general outline listed below.

Outline

1. Aspirational Target
2. General Outreach
3. Apprenticeships/On the job training
4. Workforce Diversity
5. Bid Packaging
6. Bonding/Insurance
7. Technical Assistance
8. Lewis Liaison

To date, Lewis has been working with National Association of Minority Contractors – Oregon (NAMC-O), Oregon Association of Minority Entrepreneurs (OAME), Professional Business Development Group (PBDG), National Association of Women in Construction (NAWIC) to bring awareness to the start of the Polar Passage, Primate Forest and Rhino project. Lewis as well has a developed long-standing relationship with many firms we have previously worked with on past projects, like most recently with the Oregon Zoo Elephant Lands, Roosevelt High School, and University of Oregon Erb Memorial Union. With those established relationships we will be reaching out to those teams to join our efforts at the Oregon Zoo PPR.

Section 1

Aspirational Target

COBID Aspirational Target

The Oregon Zoo Bond program has an aspirational target of 15% (by dollar value of COBID-eligible work) for each construction project.

The total construction project budget for Polar Passage/Primate Forest/Rhino is $32,935,000. The target value for COBID scopes is $4,849,088.56 (15% of total contract).

Lewis intends to subcontract all scopes of work related to the construction of the project. This approach allows for the maximum amount of advertisement and opportunity for potential COBID partners.

In addition to the bid packages outlined on the next page, Lewis has identified key scopes during the Early Work Package that will be directly awarded to a COBID certified business. Lewis will solicit bids from a minimum of three COBID firms for each scope listed and work with them to contract and complete the work. Lewis will track the outreach, bids received and contract values in the tracking sheet in alignment with our other bid activities.

The scope Lewis seeks to direct award to COBID firms in the early work bid process include:

- Steel Caging Reconfiguration/Repair, Metal Fabrications
- Metal Panels and Flashing
- Roofing/Patching
- Painting
- Concrete Masonry

Section 1

Aspirational Target

Bid Package #	Description	Approximate Dollar Value ($)	% COBID Utilization	Potential COBID Contract Dollar Value ($)
1.01	Structural Demolition, Site, Civil, and Utilities	$ 2,872,834	20%	$ 574,566.70
1.02	Plumbing and HVAC	$ 260,127	100%	$ 260,126.58
1.03	Electrical	$ 381,827	100%	$ 381,827.11
Direct	Steel Caging, Metal Panels, Flashings, Roofing, Painting, and Concrete Masonry	$ 81,000	100%	$ 81,000.00
2.01	Structural Demolition	$ 240,321	20%	$ 48,064.13
2.02	Site Civil and Utilities	$ 1,373,311	0%	$ -
2.03	Concrete Structures	$ 4,158,322	0%	$ -
2.04	Specialty Concrete & Exhibit Rockwork	$ 2,970,410	0%	$ -
2.05	Concrete Paving	$ 328,611	40%	$ 131,444.28
2.06	Waterproofing	$ 95,972	0%	$ -
2.07	Structural Steel	$ 3,066,779	20%	$ 613,355.77
2.08	Steel Caging, Animal Specialties, & Metal Fabrications	$ 1,581,052	20%	$ 316,210.47
2.09	Decorative Metal	$ 833,931	40%	$ 333,572.54
2.10	Wood Framing	$ 472,269	20%	$ 94,453.76
2.11	Masonry	$ 1,433,512	20%	$ 286,702.39
2.12	Metal Framing & Drywall	$ 593,931	20%	$ 118,786.27
2.13	Architectural Woodwork	$ 23,238	20%	$ 4,647.61
2.14	Roofing	$ 379,874	20%	$ 75,974.79
2.15	Metal Panels & Flashings	$ 147,874	20%	$ 29,574.79
2.16	Joint Sealers	$ 39,433	20%	$ 7,886.66
2.17	Door Frames, and Hardware (F&I)	$ 81,495	20%	$ 16,299.09
2.18	Curtainwall, Storefronts & Glazing	$ 1,264,587	0%	$ -
2.19	Skylights	$ 19,870	0%	$ -
2.20	Flooring and Ceramic Tile	$ 94,180	60%	$ 56,507.90
2.21	Painting	$ 76,845	60%	$ 46,106.90
2.22	Miscellaneous Accessories	$ 15,775	0%	$ -
2.23	Fire Suppression	$ 75,815	0%	$ -
2.24	Plumbing and HVAC	$ 1,978,988	20%	$ 395,797.50
2.25	Life Support System	$ 3,192,624	0%	$ -
2.26	Electrical	$ 3,195,993	20%	$ 639,198.54
2.27	Landscape and Irrigation	$ 1,203,733	20%	$ 240,746.54
2.28	Fencing	$ 356,871	20%	$ 71,374.24
2.29	Final Clean	$ 24,864	100%	$ 24,864.00
2.30	Appliances	$ 18,197	0%	$ -
	Total	**$ 32,934,464**	Total	**$ 4,849,088.56**
			% of Contract Value	**15%**

Section 2

General Outreach

Outreach Program

Lewis will maximize COBID utilization for this Project by means of the following outreach efforts in coordination with the Metro Procurement Office.

- Directly solicit quotations from MBE, WBE, SDV, and ESB subcontractors, utilizing our in-house database and the COBID directory.
- Establish bid packages in smaller work scopes, allowing smaller, yet technically qualified firms to participate.
- Publicly advertise our solicitation of bids on ORPIN, DJC Oregon and in business publications catering to DBE subcontractors.
- Deposit bid packages at centers that cater to DBE sub-contractors such as the OAME and MCIP Plan Center.
- Schedule and advertise public informational meetings to educate DBE firms about bidding opportunities, Workforce Hiring and Training Program, and to raise awareness about apprenticeship programs.
- Participate in networking sessions to increase our visibility as a prime among DBE firms.
- Utilize our online “Projects Bidding” page, which allows COBID subcontractors access to specific bid information and resources via the Internet and the Lewis Virtual Plan Center.

Plan Centers & Publications

The more COBID firms there are aware of bidding opportunities for the project, the greater the bid participation and award rates will be. In partnership with Metro, Lewis will publicize the Project through the following organizations and media outlets:

- Asian Reporter
- BESThq
- DJC Oregon
- El Hispanic News
- Minority Contractor Improvement Partnership
- National Association of Women in Construction
- Oregon Association of Minority Entrepreneurs
- Portland Area Business Association
- Portland Observer
- The ARC Plan Center
- The Asian Pacific American Chamber of Commerce
- The Metropolitan Hispanic Chamber of Commerce
- The National Association of Minority Contractors
- The Oregon Native American Chamber of Commerce
- The Skanner

Schedule of Events

Given the phasing of the project there will be many opportunities for COBID firms to compete for various scopes of work. The following schedule of deliverables represents anticipated outreach efforts for our bidding. We foresee similar outreach activities during subsequent phases.

Outreach Schedule of Events: Early Work Package Bidding*

Activity	**Date**
Promote project at OAME meetings	Every meeting until close of bid.
Promote project at NAMCO meetings	Every meeting until close of bid.
Promote project at PBDG meetings	Every meeting until close of bid.
Metro Small Business Open House	February 21st (3pm-6pm)
Metropolitan Contractor Improvement Partnership Subcontractor Tradeshow	February 22nd (12pm-4pm)
Direct calls to COBID Policy Holder subs	Month of April
Public Information	Month of April
Open House Meetings*	April 13th
Bid Advertisement in minority trade publications	Month of April
Technical bid workshops	Month of April, Weekly.

Outreach Schedule of Events: Phase II Bidding**

Activity	**Date**
Promote project at OAME meetings**	Every meeting until close of bid.
Promote project at NAMCO meetings**	Every meeting until close of bid.
Promote project at PBDG meetings**	Every meeting until close of bid.
Metro Small Business Open House	February 21st (3pm-6pm)
Metropolitan Contractor Improvement Partnership Subcontractor Tradeshow	February 22nd (12pm-4pm)
Direct calls to COBID Policy Holder subs	Month of September
Public Information	Month of September
Open House Meetings	Month of September
Bid Advertisement in minority trade publications	Month of September
Technical bid workshops	Month of September

*Dates may change depending release of Bid Packages.

**Outreach for the Main Package will continue after the Early Work Package has begun.

Section 3

Apprenticeship/OJT

On-the-job Training

Lewis promotes on-the-job training and apprenticeships in a variety of ways:

- A BOLI registered training agent, Lewis trains and mentors carpenter and laborer apprentices on most of our projects.
- With a board member and volunteers engaged in NA-WIC, Lewis contributes to and provides opportunities to women in construction at all levels of our organization, from senior management to journeyed carpenters and laborers. We participate in the annual trade fair for Women in Construction and directly mentor apprentices and trainees involved in the program. For 2018, Lewis will be participating in the career fair in order to showcase the opportunities not only Lewis is able to provide, but the industry at large for women interested in construction.
- With a board member and volunteers involved in the Architecture, Construction and Engineering (ACE) Academy in East Portland, Lewis is promoting industry interest among young people in four different metropolitan school districts with diverse ethnic back-grounds. Through our involvement, Lewis has hired several minority interns who have become apprentices on our projects and will look for additional opportunities on the Polar Bear Habitat Project. (Though ACE lost funding earlier this year, we are working with AGC to identify a strategy to maintain this program as an extension of Portland Public Schools' CTE program. We expect to continue to support the organization in its new form.) We will explore opportunities to connect with local schools' Career Technical Pathway specialists, and hire candidates who are interested in both summer internships on the construction site, and longer-term apprenticeship and journeyman positions. We have started this discussion with PPS, as we have worked with them at Roosevelt. Through our experience constructing there, we have learned that the children are passionate to learn how buildings are constructed, and are eager to see the result.
- With a board member and volunteers participating in the ACE Mentorship Program and deep involvement from ACE program inception, Lewis employees have offered advice and counsel to dozens of minority high school students over many years. We actively participate in mentoring students, believing it to be part of our company culture; giving back to our community and sharing the exciting careers available in construction.
- Lewis provides several, varying internships for college students and individuals considering a transition into a construction management career at any age. We perceive that many skills learned on the job are difficult to learn in the classroom, so we immerse interns into the thick of things while allowing them to pursue their strengths and passions, with the help of a mentor. This was recently witnessed with the growth of Sarah Jimenez, an intern for Elephant Lands, who returned to college with a greater understanding of how phasing a project can provide a benefit a client, and the General Contractor. **Sarah will be the Project Engineer on the PPR project and looks forward to mentorship from Lauren Holmes, Project Manager.**
- Lewis will work with Constructing Hope during construction of this project. Constructing Hope is an organization that participates in developing an understanding of apprenticeship opportunities that are available in the industry. We believe in the Constructing Hope mission of helping individuals develop self-sufficiency, and will reach out to the organization with the hope of providing positions for members to gain real world experience.
- In partnership with Construction Summer Camp, Lewis employed three high school carpenter apprentices at the Elephant Lands Project. A Portland Public Schools and Willamette Carpenters Training Center joint effort, the program connects high school students with diverse backgrounds interested in pursuing careers in construction with general contractors for summer internship and training opportunities.
- Lewis typically employees four apprentices each summer on projects throughout the Portland metro region.
- **Lewis plans to hire an intern and apprentice for the summers of 2019 and 2020 to assist with the Polar Passage, Primate Forest, Rhino project.**

Section 4

Workforce Diversity

Enhancing Workforce Diversity

We welcome—and proactively recruit—people of diverse backgrounds on our work crews and management teams. Lewis is a registered training agent and continually promotes apprenticeship in the trades in partnership with the local carpenters and laborers unions. Further, we sponsor programs with Oregon Tradeswomen, encourage our unions to hire women and minorities and mentor youth of diverse backgrounds to enter the construction industry.

Our approach for optimizing diversity—and providing opportunity for craftspeople new to the industry—within the workforce for this Project includes the following:

- Identify projected hiring needs and apprentice opportunities prior to finalization of the contract.
- Assist subcontractors in obtaining BOLI registered training agent certification.
- Maintain our diverse workforce and Equal Opportunity Employment Certification.
- Host workshops and participate in job fairs to recruit women and minority workers.
- Hire apprentices to work on Lewis self-perform work as applicable
- Work with our subcontracting partners that are actively promoting individuals to consider joining their trade.

We not only believe in enhancing workforce diversity, we also want to sustain it. Our approach to sustaining diversity is driven by one of our core values of Trust & Respect. Everyone should feel safe coming to work, and feel that they are a part of a community that appreciates their diversity of thought. Every member of a team is valuable, and should feel empowered to help spark innovation. The following are stories of how we have seen empowerment and encouraged innovation:

- SAIF – To reinforce that everyone should feel safe at work, Lauren Holmes, Project Manager on the SAIF project, during her walks is often found walking to a new female or person of color tradesperson on-site, Lauren will introduce herself, and let the individual know that if they ever have concerns that they can reach her by phone, or to come find her in the job trailer to discuss. **Lauren Holmes will be the Project Manager for the Polar Passage, Primate Forest, and Rhino project, and will ensure a welcoming construction site for all.**
- Block 137 – During a job walk, Kaitlyn Weaver, an intern for the summer had come across an entry that wasn't safe-d off from the overhead activity above. She brought her concern to the Project Manager on the job, and was met with instant action on her concern. Initially she had been concerned someone would dismiss her observation, but instead was met with action.
- Roosevelt High School – Sarah Jimenez was the new project engineer on site during the Fall of 2015. Her superintendent decided to partner her with a union carpenter Joseph, who had been in the industry for the last 35 years. Only the superintendent had the foresight to see that the two would further develop each other. Joe helped develop Sarah's confidence in an environment and project she hadn't been familiar with, and Sarah in part empowered Joseph with the knowledge on technology and how it is able to improve construction inefficiencies. Two years later, Joe and Sarah still work together, and have been empowered with the knowledge they have each other and are a team.

For the project, we will continue empowering and encouraging innovation by establishing mentorship opportunities within our teams, and the community. The following are the mentoring opportunities we have initiated:

- Lauren Holmes & Sarah Jimenez will be able to turn their mentor and mentee relationship into a daily learning opportunity. Sarah has expressed her interested in becoming a project manager and will look to Lauren for advice on what it means to be a project manager and how to get there.
- Phil Kreiger, our project superintendent has begun mentoring project engineers and foremen, to show individuals the growth opportunities within construction and specifically the field. With the industry growing, and more construction personnel retiring, it has become increasing important to diversify our workforce in the field.

- Sarah Jimenez has begun working with Girls Inc. to help young girls gain confidence in getting involved in the science, technology, engineering, and mathematic (STEM) industries. Sarah credits STEM programs, she was involved in, with giving her the confidence in exploring a career in Construction.
- The project team will continue to actively search for opportunities that will help enhance workforce diversity. We have found that when you have diversity and equity you are able to create our vibrant inclusive culture. A culture that at Lewis we appreciate, because it helps cultivate lasting relationships not just within our project team, but the project overall.

Section 5

Bid Packaging

Subcontractor Bid Packaging

Our bid package development process is very flexible, and adaptable for each project. For this Project we will split bid packages into multiple levels with focused scopes of work that allow smaller, yet technically qualified firms to participate. Potential opportunities include:

Early Work Package – Bid Date: May 1st 2018

- Structural Demolition
- Site Civil and Utilities
- Plumbing and HVAC
- Electrical

Early Work Package – Direct COBID Solicitation

- Steel Caging Reconfiguration/Repair, Metal Fabrications
- Metal Panels and Flashing
- Roofing/Patching
- Painting
- Concrete Masonry

Main Package – Est. Bid Date: August 2018

- Structural Demolition
- Site Civil and Utilities
- Concrete Structures
- Specialty Concrete & Exhibit Rockwork
- Concrete Paving
- Waterproofing
- Structural Steel
- Steel Caging, Animal Specialties, & Metal Fabrications
- Decorative Metal
- Wood Framing
- Masonry
- Metal Framing & Drywall
- Architectural Woodwork
- Roofing
- Metal Panels & Flashings
- Joint Sealers
- Door Frames, and Hardware (F&I)
- Specialty Doors
- Curtainwall, Storefronts & Glazing
- Skylights
- Flooring and Ceramic Tile
- Painting
- Miscellaneous Accessories
- Fire Suppression
- Plumbing and HVAC
- Life Support System
- Electrical
- Landscape and Irrigation
- Fencing
- Final Clean
- Appliances
- Kitchen Equipment

Section 6

Bonding/Insurance

Bonding & Insurance Coverage

Lewis is thoughtful in our assessment of subcontractor risk and bonding. We will assist COBID firms challenged to provide performance bonds (as required), by connecting them with sureties and helping to negotiate rates. However, as a better alternative, we have Subcontractor Default Insurance (SDI) to help protect Metro from potential defaults. SDI is more effective and less expensive than individual bonding, and eliminates the bonding burden on smaller disadvantaged subcontractors.

Insurers look to a number of business factors when binding coverage for specialty contractors. When presented with a small or emerging business, Lewis aims to partner that company with resources such as MESO and Micro Enterprise Services of Oregon who enthusiastically empower and educate small businesses. They provide additional resources including business planning, book-keeping training, consultation, credit building and access to capital—all of which contribute to a more favorable insurance rate.

Section 7

Technical Assistance

Partnerships, Mentoring & Technical Assistance

Other outreach and technical assistance measures during this phase will include:

- Public bidding opportunity sessions, targeted to COBID subcontractors and vendors
- Participation in NAMCO, PBDG, BESTHq, and OAME meetings to generate interest among disadvantaged firms
- Technical bidding classes geared toward improving the ability of COBID firms to compete for the work
- During the bid process Lewis will provide subcontractors with one-on-one scope review and clarification to ensure accurate numbers on bid day.
- During Pre-installation meetings with subs and suppliers, our team will identify any need for technical assistance and develop a plan to achieve necessary skills and resources.
- For those subcontractors and suppliers who are inexperienced with work planning, our team offers sequencing and coordination assistance.
- For emerging firms, we offer business skill training focused on subcontracts, insurance, bonding and QA/QC.
- Superintendent Phil Kreiger's daily onsite check-ins with subcontractors will ensure proper techniques and provide an opportunity for subs to seek assistance.
- Working with MCIP, to set up a plan center for COBID firms to discuss the project with our team.

Section 8

Lewis Liaison

COBID Business Liaison

COBID Liaison and Senior Project Manager Andy Dykeman and Project Engineer Sarah Jimenez will work with the subcontractors to administer our COBID program throughout construction. Andy has been continuously involved with equity in contracting programs and initiatives in the Portland Metro area for nearly 10 years, and has led outreach efforts that yielded COBID subcontractor participation rates of 30% and higher on past projects. Sarah is a member of our Diversity Community and has donated her time to mentor COBID subcontractors and has been working in conjunction with Girls Inc, to motivate young girls to join the Science, Technology, Engineering and Mathematics (STEM) industry.

Oregon Zoo Bond Project Status Report
Percent-for-Art

Oregon Zoo Bond Citizens' Oversight Committee Meeting
May 9, 2018
Agenda item D-4

Project Title: Percent-for-Art	**Project Manager:** Kate Giraud
Reporting Period #75/Status Date: April 27, 2018	**Project Manager Phone:** 503-548-2677
Project Description: Metro Council Resolution 11-4282 approved the recommendation to use the Percent-for-Art funds for zoo bond program programmatically rather than on a project-by-project basis. This enables a more strategic approach to the selection and installation of public art at the zoo and leverages the monies to greater effect for the public and the campus.	

Status at a Glance

Status Item	On Track	Caution	Off-track
Budget	X		
Schedule and signoffs	X		
Deliverables	X		

LEGEND:

	Moving along nicely, no significant concerns at this time.
	Must be addressed or may be escalated to off-track mode.
	Causing significant impact to the project.

Project Schedule

Start Date		Completion Date	
Baseline	Revised	Baseline	Revised
n/a	10/1/09	n/a	6/25/20

Project Budget and Expenditures

Budget Baseline	Costs to Date Of Status	Estimate at Completion	Estimated Budget Variance
$843,154*	$672,470	$843,154	$0

***Budget baseline includes $20,000 from an Oregon Cultural Trust grant and $30,000 donated by the Oregon Zoo Foundation to help fund the Willard Martin Mosaic restoration and reinstallation efforts.**

Critical Issues

None at this time.

Summary Status

Milestones/deliverables/information for this reporting period:

- Edwin and Veronica Dam de Nogales, the commissioned artist team for Polar Passage, noted that it will take approximately one year to complete the pieces. The rough work schedule is as follows:
  - March to June 2018 – Fine sculpting details on full-sized work before casting
  - July to September 2018 – Aluminum casting, finishing and shipping
- Five of the displaced Warren Iliff sculpture pieces have been reinstalled along Wildlife Garden Way on zoo grounds, and the sculpture garden is now open to guests. Within the next month, the sculpture of the bear and her cubs will be restored, coated with a new sealant, and the mother bear's ears will be rebuilt.

Planned milestones/deliverables for the next reporting period:

- Progress update from the artists on the Polar Passage sculpture pieces
- Determine location at the zoo to reinstall final Warren Iliff sculpture garden elephant piece.

Oregon Zoo Bond Project Status Report
Electrical Infrastructure

Oregon Zoo Bond Citizens' Oversight Committee Meeting
May 9, 2018
Agenda item D-5

Project Title: Zoo Electrical Infrastructure	**Project Manager:** John Sterbis
Reporting Period #11/Status Date: April 30, 2018	**Project Manager Phone:** 503-525-4297
Architect/Engineering Design Consultant: Various	**Construction Manager/General Contractor:** Various

Project Description: The Electrical Infrastructure project replaces two outdated emergency power generators and associated electrical infrastructure critical to servicing animal areas and supporting animal and guest safety. It includes six subprojects – each with its own scope, schedule and budget – that are being managed by zoo Facilities Management and paid with zoo bond funds, per a signed Memorandum of Understanding with the zoo bond program:

1. Lower Service Road Feeders
2. Roundhouse Automatic Transfer Switch
3. AfriCafé Panel Replacement
4. Animal Nutrition Center Panel Replacement
5. Middle Service Road Feeders
6. Generator Replacement

This project was added to the bond program by the Metro Council on March 16, 2017.

Status at a Glance

Status Item	On Track	Caution	Off-track
Budget		X	
Schedule and signoffs	X		
Deliverables	X		

LEGEND:

	Moving along nicely, no significant concerns at this time.
	Must be addressed or may be escalated to off-track mode.
	Causing significant impact to the project.

Design and Construction Schedule

Start Date		Completion Date	
Estimated	Contract	Estimated	Contract
9/1/16	various	6/15/18	10/31/18

Project Budget and Expenditures

Original Baseline	Revised Baseline	Costs to Date of Status	Estimate at Completion	Estimated Budget Variance
$1,500,000	$1,500,000*	$566,478	$1,500,000	$0

***In March 2018, the project budget and estimate at completion were updated to reflect the removal of $576,600 in resources from Portland General Electric; this amount was previously added to fund upgrades to zoo generators for Dispatchable Service Generation participation, but DSG costs exceeded the project budget and DSG was removed from the project scope.**

Critical Issues

Scope, schedule and final cost estimates have all been impacted by higher-than-anticipated construction costs, which led to the Generator Replacement and Middle Service Road feeder project being rebid with a more limited scope.

Summary Status

Milestones/deliverables/information for this reporting period:

- A contractor has been selected for the generator replacement and Middle Service Road feeder project. High Point Construction, a COBID firm, was the lowest bidder with a total cost is $812,112 for construction. Cost savings and unallocated funds in the electrical infrastructure project budget have been allocated to the Generator Replacement and Middle Service Road project to proceed with this critical infrastructure investment. Staff is flagging the budget as "caution" given the low contingency

amount ($40,000 or 4 percent of the project budget) and the unknown condition of the conduit. Staff is assessing additional contingency funding sources should underground conditions warrant additional work. Additionally, the bond team will look into efficiencies that could occur along the Middle Service Road work with construction of the Polar Passage/Primate Forest/Rhino project. Contractor estimates completion of the project by Oct. 31, 2018.

- AfriCafé electrical panel punch list items completed.

Planned milestones/deliverables/information for the next reporting period:

- Finalize contract documents for Generator Replacement and Middle Service Road feeders.

Oregon Zoo Bond Program

Project Status and Financial Information at a Glance
Expenditures and Revenue through March 2018

Oregon Zoo Bond Citizens' Oversight Committee Meeting
May 9, 2018
Agenda item E

Program Budgets and Expenditures

						Project Budgets	Zoo Bond Fund Expenditures	Nonbond Fund Expenditures	Total Project Expenditures	Project Forecasted Total Expenditures
Construction Projects	**Pre-Schematic Design**	**Design Development**	**Construction Docs**	**Contracting**	**Construction**					
Veterinary Medical Center	Complete	Complete	Complete	Complete	Complete	$ 9,464,299	$ 8,840,329		$ 8,840,329	$ 8,840,329
Penguin Life Support System	Complete	Complete	Complete	Complete	Complete	$ 1,800,000	$ 1,762,250		$ 1,762,250	$ 1,762,250
Water Main Building	Complete	Complete	Complete	Complete	Complete	$ 267,459	$ 242,495		$ 242,495	$ 242,495
Elephant Lands	Complete	Complete	Complete	Complete	Complete	$ 57,561,443	$ 54,147,246	$ 3,260,000	$ 57,407,246	$ 57,407,246
Condors of the Columbia	Complete	Complete	Complete	Complete	Complete	$ 2,628,592	$ 2,215,609		$ 2,215,609	$ 2,215,609
Remote Elephant Center					Project Eliminated	$ 117,864	$ 39,672	$ 78,191	$ 117,864	$ 117,864
Education Center % Complete	Complete	Complete	Complete	Complete	Complete	$ 17,699,157 Note 1	$ 15,787,959	$ 1,613,343	$ 17,401,302	$ 17,482,791
Polar Passage/Primate Forest /Rhino % Complete	Complete	Complete	25%	Complete		$ 43,802,256	$ 2,546,798		$ 2,546,798	$ 43,802,256
Electrical Infrastructure % Complete					38%	$ 1,500,000 Note 2	$ 566,478		$ 566,478	$ 1,500,000
Close-out Contingency % Complete						$ 1,000,000	$ 5,660		$ 5,660	$ 1,000,000
Interpretives	**Condors Interp.**	**Elephants Interp.**	**Wayfinding**							
Program Interpretive Experience % Complete	Complete	Complete	95%			$ 2,766,640	$ 2,199,248	$ 301,993	$ 2,501,240	$ 2,766,640
Percent-for-Art	**VMC Art**	**Art Program Planning**	**East Plaza Art**	**West Plaza Art**	**Central Plaza Art**					
One-Percent-for-Art Requirement % Complete	Complete	Complete	Complete	Complete	50%	$ 843,154	$ 622,470	$ 50,000	$ 672,470	$ 843,154
Planning Projects	**Proposals Submitted**	**Contract Award**	**Interim Reports**	**Final Deliverables**	**Close-out**					
Comprehensive Capital Master Plan	Complete	Complete	Complete	Complete	Complete	$ 1,850,000	$ 1,691,504		$ 1,691,504	$ 1,691,504
Stormwater/ Wastewater Analysis	Complete	Complete	Complete	Complete	Complete	$ 160,000	$ 159,979		$ 159,979	$ 159,979
Stormwater Minor Projects & Campus Surv	Complete	Complete	Complete	Complete	Complete	$ 386,797	$ 386,797		$ 386,797	$ 386,797
Land Use Processes	**Project Scope and Baselines**	**Technical Studies and Application**	**Public meetings**	**Submit CU MS to City for Approval**	**Land Use Approval Process**					
Land Use – New CUMS	Complete	Complete	Complete	Complete	Complete	$ 796,785	$ 816,777		$ 816,777	$ 816,777
Land Use – Amended CUMS	Complete	Complete	Complete	Complete	Complete	$ 110,429	$ 142,617		$ 142,617	$ 142,617
Program Administration										
Program Administration, Metro Central Support and Bond Issuance						$ 7,200,000	$ 5,607,180		$ 5,607,180	$ 7,200,000
Unallocated Program Contingency										
Unallocated Program Contingency										$ 2,167,255
					Expenditure Totals		**$ 97,781,065**	**$ 5,303,527**	**$ 103,084,592**	**$ 150,545,561**

Program Resources

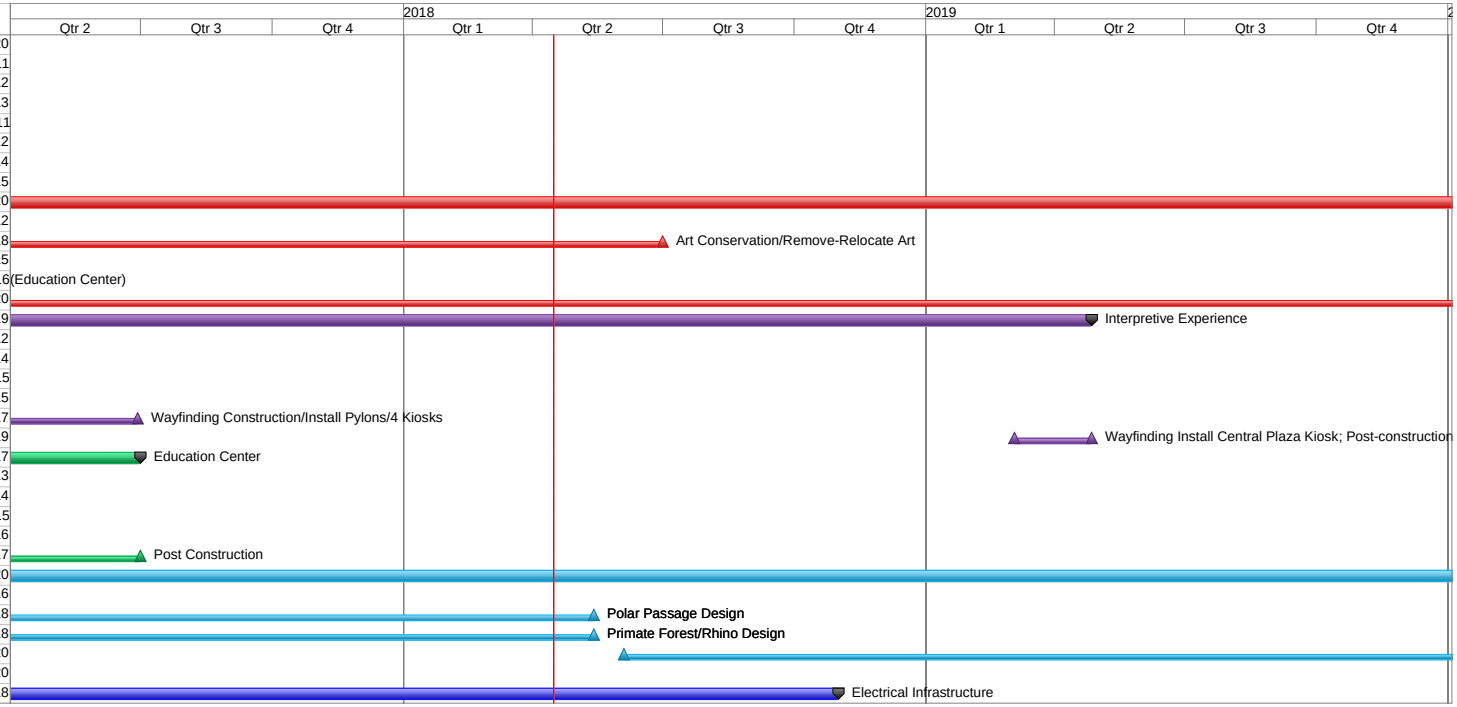
	Expected Amount	Zoo Bond Fund Revenues Received	Nonbond Revenues Received	Total Revenues Received/Issued	Funds Not Yet Received
General Obligation Bonds, premiums and interest	$ 141,184,623	$ 130,864,912		$ 130,864,912	$ 10,319,711
Oregon Zoo Foundation	$ 7,918,000		$ 6,018,000	$ 6,018,000	$ 1,900,000
Grants, donations, rebates and partner investments	$ 1,442,939		$ 1,057,605	$ 1,057,605	$ 385,334
Resource Totals	**$ 150,545,561**	**$ 130,864,912**	**$ 7,075,605**	**$ 137,940,516**	**$ 12,605,045**

Reports will show newly added items for two months' reports:
Note 1 - In December 2017, the Education Center budget was updated with all allocated resources (added $195,032).
Note 2 - In February 2018, $576,600 for PGE Dispatchable Service Generation was removed from the project budget and forecasted revenue because costs for DSG partnership would exceed the budget.

PROJECTS SCHEDULE
Oregon Zoo Bond Program
As of April 27, 2018

Oregon Zoo Bond Citizens'
Oversight Committee meeting
May 9, 2018
Agenda item F

Task Name	Start	Finish
Consolidated Bond Program Schedule	10/1/09	8/13/20
Water Main Building	10/26/09	7/29/11
Veterinary Medical Center	11/12/09	1/24/12
Land Use Permits	3/16/10	1/28/13
Comprehensive Capital Master Plan	6/2/10	11/3/11
Penguinarium Filtration	11/1/10	2/29/12
Condors of the Columbia	7/25/12	3/4/14
Elephant Lands	11/7/11	12/7/15
Percent for Art	10/1/09	6/25/20
VMC Commissioned Art	10/1/09	1/24/12
Art Conservation/Remove-Relocate Art	5/16/12	6/30/18
Major Art Commission #1 (Elephant Lands)	5/13/13	9/30/15
Major Art Commission #2 (Education Center)	4/1/14	11/30/16
Major Art Commission #3 (Polar Passage)	3/1/16	6/25/20
Interpretive Experience	3/19/12	4/26/19
Interpretive Roadmap	3/19/12	9/30/12
Condors of the Columbia Intepretives	6/14/12	3/7/14
Elephant Lands Interpretives	6/25/12	11/13/15
Wayfinding Design/Solicitation	3/17/14	12/31/15
Wayfinding Construction/Install Pylons/4 Kiosks	1/2/16	6/28/17
Wayfinding Install Central Plaza Kiosk; Post-construction	3/4/19	4/26/19
Education Center	3/21/13	6/30/17
Early Demolition	3/21/13	6/12/13
RFP Design	1/21/14	4/18/14
Design	4/21/14	9/11/15
Construction	9/15/15	12/28/16
Post Construction	12/29/16	6/30/17
Polar Passage/Primate Forest/Rhino	2/9/16	8/13/20
RFP Design	2/9/16	6/20/16
Polar Passage Design	6/21/16	5/13/18
Primate Forest/Rhino Design	11/17/16	5/13/18
Construction	6/4/18	6/19/20
Post Construction	6/22/20	8/13/20
Electrical Infrastructure	9/1/16	10/31/18



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Oregon Zoo Bond Citizens' Oversight Committee Meeting
May 9, 2018
Agenda item G

How Elephant Lands Enhances Elephant Welfare
Executive Summary – May 2018

Elephant Lands was designed to encourage activity, promote a diverse range of natural behaviors, offer increased opportunities for choice and social interaction, and provide biologically meaningful challenges for Asian elephants at the Oregon Zoo. Results of this welfare study show that the zoo has achieved its goals with Elephant Lands.

For more than 60 years, the Oregon Zoo has been advancing the care and welfare of Asian elephants as well as scientific knowledge about this highly endangered species. In designing its new Elephant Lands habitat, the zoo's decisions were informed by research on both wild Asian elephants and elephants in zoos, drawing on decades of hands-on experience and a deep understanding of individual elephant's needs. A welfare-based approach to design sought to provide Portland's elephant family with increased choice and the opportunity to engage in a wide range of natural behaviors associated with their biological, social, physiological and psychological needs.

A four-year study was designed to evaluate the effectiveness of Elephant Lands through scientific assessment of welfare measures before, during and after transition to the new habitat. Data collection began in September 2012, prior to the start of construction, and continued through the end of 2016, one year after Elephant Lands' grand opening. Welfare indicators included distance walked through GPS monitoring, reproductive and adrenal hormone analyses, and detailed behavior assessments. Results of this welfare study show the zoo has achieved its goals. The elephants are more active, they are exhibiting more choice and self-determination throughout their day, they are expressing a diverse range of species-typical behaviors, and they have biologically meaningful challenges.

Distance Walked: A previous multi-institutional study of zoo elephants found an average walking distance of 3.3 miles per day, comparable to reported averages of 1.9 to 7.5 miles per day in wild Asian and African elephants. As part of that nationwide study, Sung-Surin walked an average of 4.7 miles per day in the former Oregon Zoo habitat, and Chendra averaged 10.7 miles per day. In Elephant Lands, anklets equipped with GPS data loggers were worn by the same two females plus two males. Data indicated that, on a daily basis, Oregon Zoo elephants walk at least as far as – and at times farther — than their wild counterparts. Chendra walked an average 10.9 miles a day, and Samudra walked at least 6 miles a day. Sung-Surin walked an average of 9.6 miles a day, double her average in the former elephant area. The elephants are regularly utilizing the various components and features of their new environment and exerting more choice and control.

Adrenal and Reproductive Hormones: Hormone measurements provide information on reproductive state and adrenal activity, which helps to assess the physiological aspect of animal health and well-being. Reproductive hormones have been measured in female Oregon Zoo elephants since 1979 as part of routine management, and historically all have shown normal reproductive cycles even through periods of major social change. Females continued cycling regularly throughout the transition to Elephants Lands, which is one indicator of normal reproductive health. Adrenal hormone metabolites in fecal samples were measured in the former elephant area, during the transitional period, and for the first year in Elephant Lands. In all cases, the greatest variability in adrenal activity occurred during the transitional period, suggesting adaptive and normal adrenal responses to life changes, challenges and excitement. All elephants adapted well to the new environment, responding with reduced adrenal activity over time and returning to baseline levels during the first year in the new space. Current adrenal activity appears well within the normal range for each individual and provides an indicator of positive welfare responses.

Behavior: Measurements used to compare behavior in Elephants Lands to the former habitat included activity budgets (proportion of time spent engaged in certain behaviors), proportion of time engaged in active vs. inactive behaviors, proximity of elephants, and relative usage of resources in their habitat. Results show increased activity, increased foraging/feeding behavior, and increased choice and control over environment and social interactions. In Elephant Lands, the elephants spend the majority of their time socializing and interacting with their environment in a social context (22%), seeking food and feeding (40%), moving and resting (20%). The elephants are engaged in a diverse range of natural behaviors and demonstrating the social dynamics of a healthy herd 24 hours a day.

We are continuing long-term scientific monitoring, which will help fine-tune the habitat to maximize welfare for all individuals in the herd.

How Elephant Lands Enhances Elephant Welfare
Oregon Zoo Bond Citizens' Oversight Committee Report – May 2018

Elephant Lands was designed to encourage activity, promote a diverse range of natural behaviors, offer increased opportunities for choice and social interaction, and provide biologically meaningful challenges for Asian elephants at the Oregon Zoo. For more than 60 years, the Oregon Zoo has been advancing the care and welfare of Asian elephants as well as the scientific knowledge about this highly endangered species.

Many important discoveries have been made at the Oregon Zoo, including the characterization of the female estrous cycle using hormones (Hess et al., 1983), the chemical signals indicating females' readiness to breed (Rasmussen et al., 1996) and chemicals produced by males signaling a change in reproductive state (Rasmussen et al., 1984; Rasmussen et al., 1990; Rasmussen and Greenwood, 2003). Elephants here have participated in many studies to improve the welfare of all elephants under professional care, from research on foot health and veterinary care to studies of body condition and health markers as diagnostic tools. The Oregon Zoo was one of seven partners in a groundbreaking welfare study of more than 95% of the elephant population in facilities accredited by the Association of Zoos and Aquariums (AZA). This study evaluated how environmental variables influenced indicators of well-being (Meehan et al., 2016) , and many of the outcomes supported the design decisions made for Elephant Lands, which were informed by decades of research, hands-on experience and an understanding of elephants' individual needs.

Animal welfare – according to the current AZA definition – refers to an animal's collective physical, mental and emotional states over a period of time, and is measured on a continuum from good to poor. Years before Elephant Lands became a reality, Oregon Zoo staff decided to take a welfare-based approach in its design – an approach focused on meeting the elephants' physiological, psychological and social needs 24 hours a day. Elephant Lands was designed to encourage activity, promote a diverse range of natural behavior, offer increased opportunities for choice and social interaction, and provide biologically meaningful challenges for its resident herd of Asian elephants. The importance of providing zoo animals with appropriate challenges (Clark, 2017) and the related variables of choice and control (Buchanan-Smith and Badihi, 2012) through environmental enrichment (Shepherdson et al., 1993; Shepherdson et al., 1998) has been convincingly documented for a wide variety of species, including elephants (Shepherdson, 1999; Wagman et al., 2018). The recently published multi-institutional elephant welfare study found social and management factors were important for multiple indicators of welfare in both Asian and African elephants (Meehan et al., 2016).

To promote a diverse range of species-typical behaviors, Elephant Lands needed to include everything the herd would need to thrive – flexible space with a variety of features to seek out and interact with, more choice and an increased level of self-directed control over their daily lives, and the ability to live in multi-generational matrilineal groups, which bulls can join occasionally as they would in free-ranging populations (McKay, 1973). Elephant Lands was designed with flexibility in resources to encourage foraging and exploration. A diversity of feeding methods provides foraging opportunities 14-16 hours per day, which more closely mimics the grazing habits of free-ranging elephants. Throughout the habitat, timed feeders release food at programmable intervals, overhead feeders require elephants to stretch and sometimes climb on logs, concrete herd feeders require reaching down, and other puzzle feeders demand manipulation to acquire food. The expanded habitat size allows for increased walking distances, and the hilly terrain, climbing features, and varied surfaces – including deep sand, hills of dirt, patches of grass and clay – provide stimulation and physical challenges.

A four-year study was designed to evaluate the effectiveness of Elephant Lands through scientific assessment of welfare before, during and after transition to the new habitat. Data collection began in September 2012, prior to the start of construction, and continued through the end of 2016, one year after Elephant Lands' grand opening. Welfare indicators included distance walked through GPS monitoring, reproductive and adrenal hormone analyses, and detailed behavior assessments.

Distance Walked

It is well known that wild elephants are highly mobile, and daily walking distances vary dramatically depending on conditions. The walking behavior of wild elephants has been measured under different environmental conditions using a variety of techniques, from radio-collaring to observers following individuals and herds. Methodology for measuring movement of free-ranging animals is often based on relatively low sampling rates, which may result in an underestimate of total distance walked. Reported average walking distances of wild Asian and African elephants are 1.9 to 7.5 miles per day under normal environmental conditions, and can range up to 16.8 miles per day or more for seasonal migrations and under extreme conditions such as drought (Sukumar, 2003; Leighty et al., 2009; Rowell, 2014). Data gathered by Smithsonian scientists in Myanmar show that wild elephants there typically walk less than 1 to 4 miles per day, and that their home range size varies depending on quantity and quality of food and whether or not the area is occupied by bulls or by cows and their offspring (2018).

Movement in wild elephants is affected by a variety of factors, including age and sex of the individual, the distribution and availability of resources, and social groupings (McKay, 1973; Whitehouse and Schoeman, 2003; Slotow and van Dyk, 2004; Leighty et al., 2009). The relationship between resource availability and distances traveled suggests that walking varies in response to external conditions. Under professional care, food and water resources are provided so the need for walking is reduced. However, walking also supports exploratory behavior, which has an information-gathering function and may be rewarding in itself. In addition, there is evidence that exercise provided by walking improves animal health.

Walking Distance in Zoo Elephants and in the Former Oregon Zoo Habitat

In 2012, scientists measured outdoor walking distance in 56 adult female African and Asian elephants, 12 years and older, in 30 North American AZA zoos (Holdgate et al., 2016) as part of a larger multi-institutional welfare study (Meehan et al., 2016). Elephants with outside access for at least 20 hours in a 24-hour period walked between 0.75 and 10.8 miles per day with an average of 3.3 miles (Holdgate et al., 2016), comparable to reported averages of their wild counterparts.

Feeding strategy and social groupings were important factors in the study. More diverse feeding regimens correlated with increased walking, and elephants that were fed on an unpredictable schedule walked 0.8 miles a day more than elephants fed on a predictable schedule. Distance walked was also positively correlated with an increase in the number of social groupings and negatively correlated with age – i.e., younger adults walked farther (Holdgate et al., 2016).

As part of that nationwide study, Sung-Surin walked an average 4.7 miles per day in the former Oregon Zoo habitat, and Chendra averaged 10.7 miles per day.

Methods for Measuring Walking Distance in Elephant Lands

Anklets equipped with GPS data loggers were worn by two females and two males (Figure 1) for 24-hour periods approximately every two weeks from June 2014 through December 2016. We wanted to compare outdoor daily walking distance in Elephant Lands to the previous habitat, so we used the same proven methods as the 2012 study.

GPS units were programmed to record data points at five-second intervals. Each data point includes the date, time, latitude, longitude, and two indices of estimate quality – number and geometry of satellites used – in each location (Holdgate et al., 2016).

Figure 1: Samudra wearing a GPS anklet and walking with Lily

GPS data is unreliable when communication between satellites and receivers is obstructed, for example under a dense forest canopy or inside a building. Data points known to have occurred while the elephants were indoors were removed. In ArcMap software, we used Google Earth imagery and defined habitat boundaries (Figure 2). We then mapped the GPS data onto the exhibit and used the clip function to remove any remaining data from indoor areas and any data that fell outside of the boundaries. Clipped data was exported to Excel, then data points that failed to meet location estimate quality criteria were removed. The Euclidean (straight line) distance between consecutive data points was calculated, then screened for distances greater than an elephant can travel using a near maximal velocity of 6.8 m/s measured for elephants (Hutchinson et al., 2006). The final straight-line distance between consecutive data points was then summed to get total distances traveled for each day.

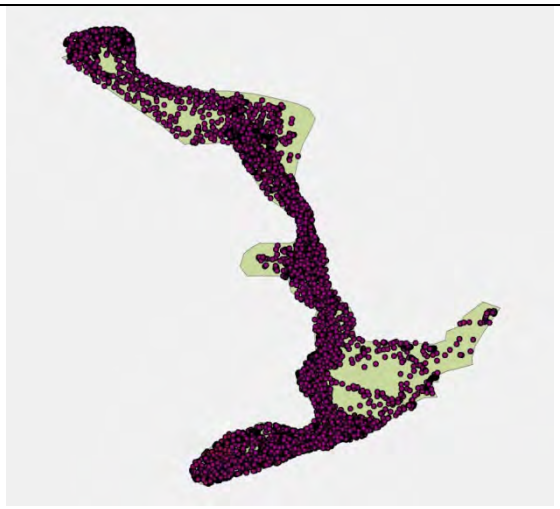
Figure 2: Outdoor habitat area in ArcMap

In 2012, GPS data was collected for five days during one month that minimized inter-zoo variation in predicted daily temperature (August for the Oregon Zoo). Walking distance was measured only for elephants that had outdoor access for at least 20 of the 24 hours for at least three days. For comparison of distance walked in Elephant Lands to the previous habitat we used the same criteria of 20 hours and the same season.

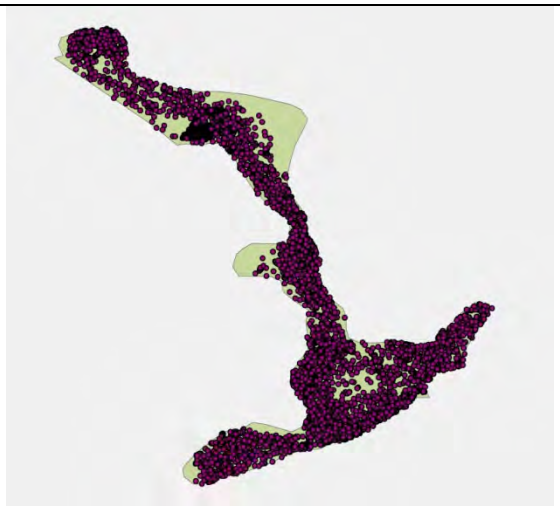
Walking Distance in Elephant Lands

Sung-Surin has doubled her average daily walking distance to 9.6 miles per day, with a maximum of 12.9 miles outside. Chendra is still walking long distances on a daily basis at an average of 10.9 miles per day, with a maximum of 14.7 miles outside. Samudra walked about 6 miles per day outside, but on the days when we measured his walking he chose to spend most of his time indoors. (We know that the elephants walk even farther than GPS calculations show since we counted movement only in outside habitats due to GPS receiver limitations; they also walk and exercise regularly in the large indoor habitat known as Forest Hall.)

GPS mapping (Figure 3) shows how elephants use the space and resources in the outdoor portion of Elephant Lands. From these maps, we can see they are using all the habitat areas and features rather than concentrating their use in just a few preferred areas. The space-use patterns clearly suggest this is the result of the increased variety of feeding and enrichment opportunities designed into the habitat.



Chendra: Using habitat and resources nearest public viewing areas, plus the dirt mounds and feeders at the top of the hill in North Meadow (August 2016)

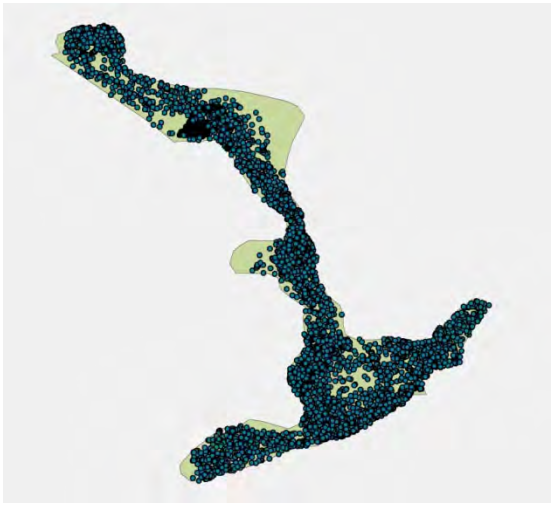


Chendra: Using entire habitat except dirt mounds (November 2016)

Sung-Surin: Checking feeders in the North but feeding mostly in the South (April 2016)

Samudra: Using the entire habitat, including pools and dirt mounds, with some preference for feeders at the top of North Meadow (12 hours, May 2016)

Sung-Surin: Using the entire habitat and diversity of food resources and features (August 2016)



Sung-Surin: Similar to usage in August 2016 (left), but in the cooler weather (November 2016)

Figure 3: GPS data in outdoor habitats of Elephant Lands for two females and one male at different times of year.

Movement in Elephant Lands is more self-directed than in the former habitat. In 2016, Oregon Zoo elephants had outdoor access for more than 20 hours a day in every month of the year except January, and individuals chose to spend anywhere from 4 to 20 hours outdoors. Even on colder days, some individuals chose to leave the heated indoor area and spend more time outdoors, while other members of the herd chose to remain indoors.

The elephant groups are dynamic and within a habitat individuals can choose who to spend time with. The zoo supports individual choice and also creates opportunities for group bonding with large browse feedings that encourage the herd to eat and interact together.

Based on the data available from studies of wild elephants, the elephants at the Oregon Zoo appear to walk at least as far as, and possibly farther, than their wild counterparts do on a daily basis. Perhaps this is in part due to the fact that they are secure to move as individuals and their movement is not limited by the group composition or need. Wild herds with a nursing calf or old or sick elephants will have to move more slowly; but the elephants here can move as individuals in safety with their resource needs met.

Summary Points on Walking Distance:

- Average daily walking distance was measured for two female and two male Asian elephants.
- Oregon Zoo elephants appear to walk at least as far as, and possibly farther, than their wild counterparts on a daily basis.
- Chendra walks an average 10.9 miles a day.
- Sung-Surin walks an average of 9.6 miles a day, double her average in the previous elephant area.
- Samudra walks at least 6 miles a day.
- The elephants are utilizing the entire habitat regularly and can choose to move indoors or outdoors.
- Movement in Elephant Lands is more self-directed – the elephants have more choice and control.

Adrenal and Reproductive Hormones

Long-term research on reproductive hormones at the Oregon Zoo began with the characterization of the female estrous cycle in 1983 and is part of an ongoing endocrine-monitoring program for this species. Hormone measurements can provide information on reproductive state and on adrenal activity, which helps to assess the physiological aspect of animal health and well-being (Wielebnowski et al., 2002a; Wielebnowski et al., 2002b; Wielebnowski, 2003). Long-term monitoring facilitates the assessment of changes and trends over time, and this allows us to see normal variation that needs to be taken into account when assessing the impact of any perceived stressors (Shepherdson et al., 2004).

The zoo's longitudinal hormone data provide important baseline information for interpreting hormone results of this study on an individual and group basis. The Oregon Zoo has the longest-running elephant hormone dataset in the world, with weekly samples spanning over two decades from Asian elephants that are both wild-born and zoo-born, male and female, breeding and non-breeding, from less than 1 year of age through puberty and senescence. This dataset allows us to assess reproductive health of elephants over much of their lifetime. In our study of gonadal (Glaeser et al., 2012) and adrenal function in female Asian elephants over 20 years, we found that major life events – births, deaths, changes in herd structure – had minimal effect on estrous-cycle dynamics over time, suggesting that the zoo's female elephants are quite resilient and maintain normal reproductive health throughout their lives (Glaeser et al., 2012). Male elephants at the zoo have experienced typical cycles of musth, a physiological and behavioral phenomenon characterized by increased testosterone, heightened aggression and sexual behavior, and a temporary rise in dominance (Jainudeen et al., 1972; Hall-Martin and van der Walt, 1984; Poole, 1987; 1989a; b). In our study on the association of serum testosterone with development, aging and major life events over 20 years, the youngest male (Rama) showed an increase in testosterone concentrations with age during his early musth cycles, and we have noted similar patterns in the sub-adult male Samudra.

For our Elephant Lands study, we monitored adrenal activity specifically in addition to reproductive cycles and health. The adrenal response is an adaptive response (to a real or perceived stressor) whereby a suite of physiological and behavioral changes occur to help deal with the stressor and re-establish equilibrium. The net effect of an acute stress response is to increase glucose and oxygen for brain and muscle function. When there is a major change constituting a

real or perceived stressor, we see this adaptive physiological response that includes resilience, whereby glucocorticoid (e.g., cortisol, corticosterone) concentrations are temporarily elevated and subsequently decrease back to a baseline in an individual. Adaptive adrenal responses to changes such as moving to a new habitat, transitioning through construction and various habitat changes, breeding events, births, etc., are expected therefore and a normal part of any individual's life. Through our ongoing monitoring we wanted to make sure that individuals could properly deal with changes in a normal and adaptive manner for the species and that these responses would not have any long-term negative effects but rather beneficial effects over time.

Methods for Measuring Hormones

Reproductive hormones in serum samples have been routinely measured in Oregon Zoo elephants. Progesterone and testosterone were measured in weekly serum samples throughout the duration of this four-year study, and continue to be measured in the zoo's endocrine lab. For this study, we used a radioimmunoassays (RIA) that has been used successfully in tracking progesterone and testosterone profiles in elephants (Brown and Lehnhardt, 1997; Brown et al., 1999; Brown, 2000; Brown et al., 2007; Glaeser et al., 2012), then switched in 2015 to an enzyme immunoassays (EIA) validated for Asian elephants (Oregon Zoo, unpublished).

Adrenal hormone metabolites were measured in fecal samples collected weekly from September 2012 through December 2016 for all individuals. Fecal samples were collected when the time of defecation was between 7 and 11 a.m. to eliminate possible effects of diurnal variation in hormone concentrations. Concentrations of glucocorticoid metabolites in fecal samples were measured at the Smithsonian's Conservation Biological Institute endocrinology lab (Front Royal, VA) using an enzyme immunoassay (EIA) previously validated for Asian elephants (Brown, unpublished data).

Results of Hormones Measurements

All females at the zoo historically cycle normally (Glaeser et al., 2012) and continued cycling regularly throughout the period of major change and in Elephant Lands (Figure 4), which provides one indicator of normal reproductive health for the herd (Glaeser et al., 2012).

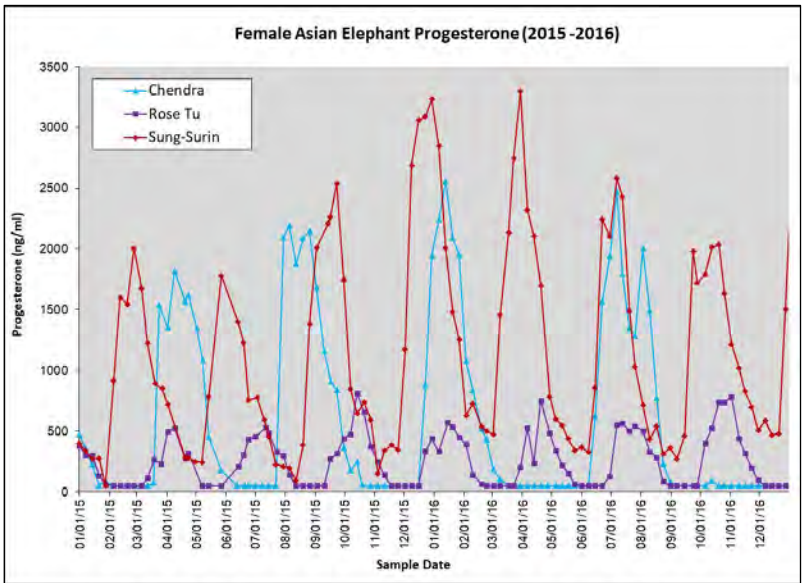


Figure 4: Serum progestagen profiles for adult female elephants 2015 and 2016 showing an example of charts sent weekly for routine elephant management.

For all individuals, the greatest variability in adrenal activity occurred during the period of major changes (Figure 5), suggesting adaptive and normal adrenal responses to life changes, challenges and excitement (e.g., moving out of known areas and exploring new areas, learning new routines and enrichment choices). Sung-Surin also exhibited some short elevations in the new habitat.

As expected in healthy individuals, Sung-Surin, Rose-Tu and Samudra showed increased levels of adrenal activity during the period of major changes and lower baseline adrenal activity levels in the former and the new habitats.

Chendra exhibited a somewhat different pattern than the other adults, showing continued increased levels of adrenal activity in Elephant Lands. However, she did show a decline in adrenal hormones immediately following the major changes and transition to the new habitat, indicating normal adaptive responses. In the new habitat, Chendra spends more time with Samudra than the other females, which may explain fluctuations in her adrenal activity leading to an overall increase in adrenal activity compared to the former habitat. Reproductive and breeding-related behaviors can temporarily increase adrenal activity and thus affect the overall mean in this case (Glaeser et al., unpublished data).

Lily was born only months prior to the start of construction and therefore we compared only the period of major change and her first year in Elephant Lands. As with the adults, she shows greater variability and higher baseline adrenal activity during the period of change; however, this study spanned ages 1 to 4, and it is not known how adrenal activity changes during early development in elephants.

It is important to note that we continue to monitor all the elephants closely to ensure that adrenal activity remains normal and adaptive.

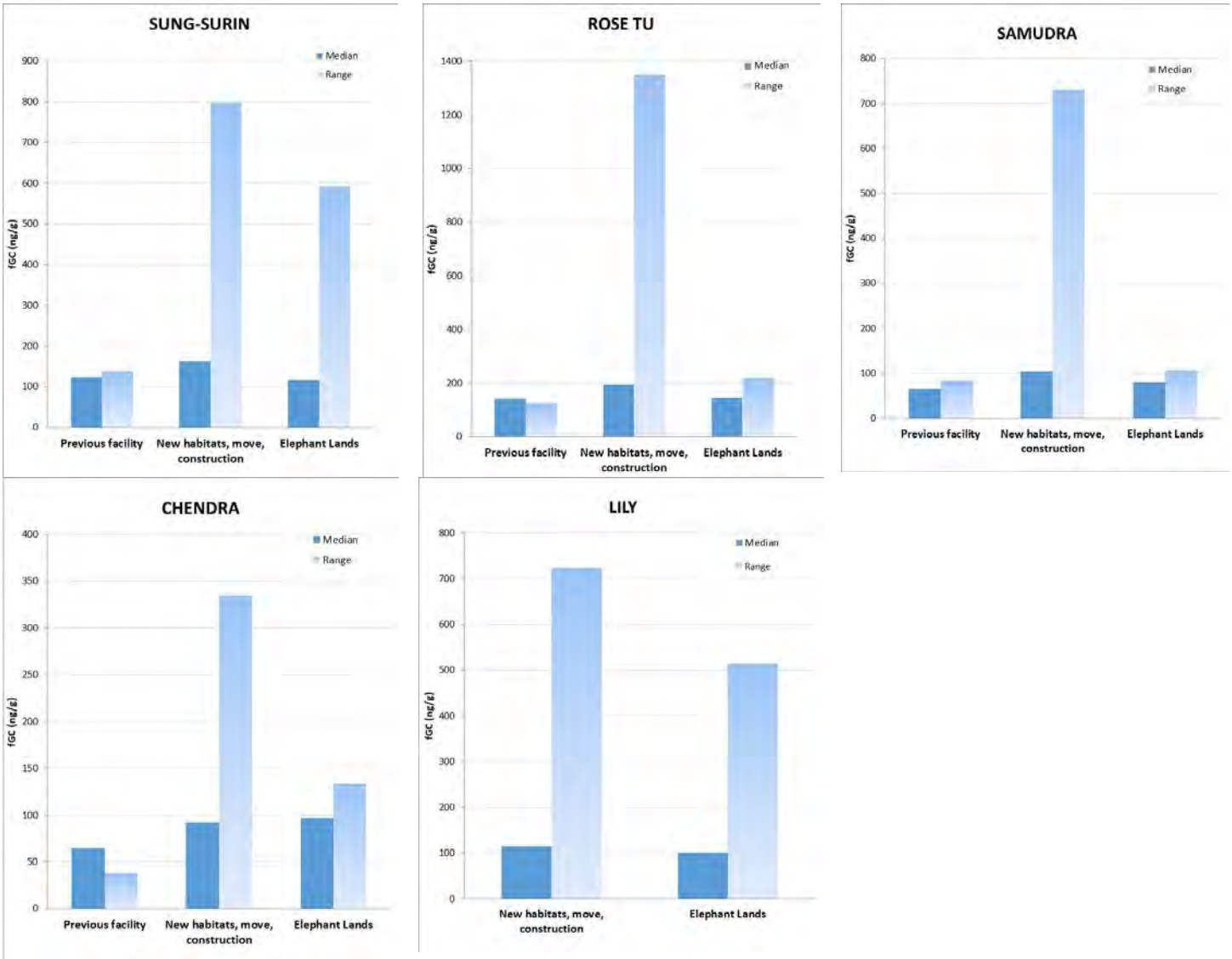


Figure 5: Concentrations of adrenal hormones (fecal glucocorticoid metabolites) comparing general levels (Median) and variability (Range) between the previous elephant area prior to the start of construction, a period of major change (new habitats, move into Forest Hall, construction), and the first year in Elephant Lands.

Summary Points on Hormone Measurements:

- Reproductive hormones in elephants are measured as part of routine management.
- Adrenal hormone metabolites were measured in the previous elephant area, during the period of major change, and the first year in Elephant Lands.
- The adult females continuing cycling regularly throughout the period of major change and in Elephants Lands, which is one indicator of normal reproductive health for the herd.
- All individuals exhibited the greatest variability in their adrenal activity during the period of major changes, suggesting adaptive and normal adrenal responses to life changes, challenges and excitement.
- We continue to monitor all the elephants closely to ensure that adrenal activity remains normal and adaptive.

Behavior

The behavior study was designed to assess Elephant Lands' effectiveness in providing increased opportunities for choice (social, food source and resource use), increased activity, and increased opportunity to express natural behaviors. Measurements of behavior included activity budgets (proportion of time spent performing behaviors), proportion of time performing active vs. inactive behaviors, proportion of time in proximity of other elephants, and relative usage of resources in their habitat.

Methods for Measuring Behavior

Behavior data collection was designed to capture both morning and afternoon periods on a weekly basis. Video was recorded every other week, on alternating Saturdays and Mondays, during two 2-hour time periods (10 a.m.–noon and 2 p.m.–4 p.m.). Every elephant in the public viewing areas (inside and outside habitats) was monitored. Each focal animal was recorded for 2 minutes once every 30 minutes, beginning at the start of the hour and half hour. Video was recorded by a team of 14 volunteers from the zoo's Visitor Animal Survey Team (VAST).

An ethogram (list of species-specific behaviors with definitions) was constructed with elephant-specific behaviors defined in published sources (Eisenberg et al., 1990; Olson, 2004; Greco et al., 2016) and unpublished studies at the Oregon Zoo. Behavior descriptions used objective definitions (i.e., without interpretation of intent or purpose) such that behaviors could be recognized by multiple observers without expertise in elephant behavior. Specific behaviors were organized into behavior groups (Table 1), and behavior modifiers were defined for details of social interaction and resource use. This ethogram can be used at a high level for basic monitoring or can be drilled down to answer more detailed questions about social interactions and resource use; it is being used for ongoing behavior monitoring of elephants at the Oregon Zoo.

Table 1: Elephant Behavior Ethogram

Proximity	***Definition***
Not proximate	Focal is more than 2 body lengths from another individual.
Proximate	Focal is within 2 body lengths of or in contact with another individual. 2 body lengths defined as: 2 adult female body lengths (c.a. 10m) [modifier: Individuals within 2 body lengths of focal]
Proximity Not Visible	The focal animal or other elephants are not visible enough to determine proximity
Behavior Group	***Definition***
Behavior Not Visible	Elephant or activity is not visible enough to determine the behavior at the beep.
Social_Physical Contact	Physically contacting 1 or more elephants in a social context (e.g., trunk twine, play). [modifier: Sender/Receiver or Partner]

Social_No Contact	Interacting with 1 or more elephants without physical contact but within 2 body lengths (e.g., sharing food, displace). [modifier: Sender/Receiver or Partner]
Food Object Interaction	Interacting with any item that distributes food, either permanent or keeper-provided. [modifier: food object]
Feeding/Drinking	Picking up, manipulating, and/or consuming any food item without interacting with an object. Drinking water without bathing. [modifier: source of food or water]
Enrichment (non-food) Object Interaction	Interacting with non-food items that are not permanent (e.g., firehose ball or braid) [modifier: enrichment object]
Environmental Interaction	Interacting with features that are permanent in the habitat (e.g., dusting, bathing, digging, pushing or climbing on logs) [modifier: environmental feature]
Repetitive Behaviors	Repeatedly performing a behavior for 3 or more consecutive repetitions without interruption (e.g., route tracing). [modifier: form of behavior]
Locomotion	Walking or running (fast walking) more than 2 body lengths in any direction, without stopping for 3 sec or more.
Stationary	Standing, shuffling/stepping without moving 2 body lengths, sitting, or lying for 3 sec or longer. [modifier: location]

Behaviors are coded from digital video by observers trained to meet 85% inter-observer reliability criteria, which to date includes the principal investigator for this study and VAST volunteers. The behavior of each individual is measured using focal animal sampling. The frequency of behaviors is being measured using instantaneous sampling, with a sampling interval of 30 seconds – short enough to capture rare behaviors but long enough to ensure behaviors are independent. At every sampling interval, observers code keeper presence, proximity of focal to other elephants, and a single behavior within the top-most behavior group that applies. Keeper presence is recorded to ensure only self-initiated behaviors are included in the analysis.

Observation and data are exported to Excel for charting and descriptive statistics.

Results of Behavior Measurements

In general, elephants spend the majority of their time in Elephant Lands socializing and interacting with their environment in a social context (22%), seeking food and feeding (40%), moving and resting (20%), with a smaller portion of their time spent interacting with enrichment objects and features in their environment in a non-social context (e.g., in the pool alone) (6%). By comparison, time spent performing repetitive behaviors is minimal (less than 3%) (Figure 6).

In Elephant Lands, elephants are seeking out their own food. Food Object Interaction has increased dramatically (average 20% increase), while Feeding/Drinking without interaction with a food object has decreased (average 20% decrease). This shows a switch from keeper-delivered food in the previous habitat to feeding from items that distribute food, such as the timed feeders, overhead feeders, concrete herd feeders, and puzzle feeders. In the previous habitat, keepers provided an array of food puzzles and scattered food to extend the duration of feeding and encourage investigation during and after staffed hours. The average time during staffed hours spent seeking food and eating did not change (40%), but findings here indicate that the food-delivery resources designed into Elephant Lands are achieving the goal of providing foraging opportunities through a diversity of feeding methods throughout the entire day, which is

further supported by the observed increase in locomotion for Samudra, Rose-Tu and Lily (average 7% increase) and the measured increase in daily walking distance for both Chendra and Sung-Surin (see results for GPS monitoring).

In general, the percentage of time performing active behaviors has increased (average 3.5% increase) while Stationary has decreased slightly (average 2.5% decrease), which indicates that Elephant Lands encourages activity as designed. Samudra exhibited a decrease of 2% in active behaviors; however, in the previous habitat he was ages 4 to 6 years so a decrease in activity is not uncommon.

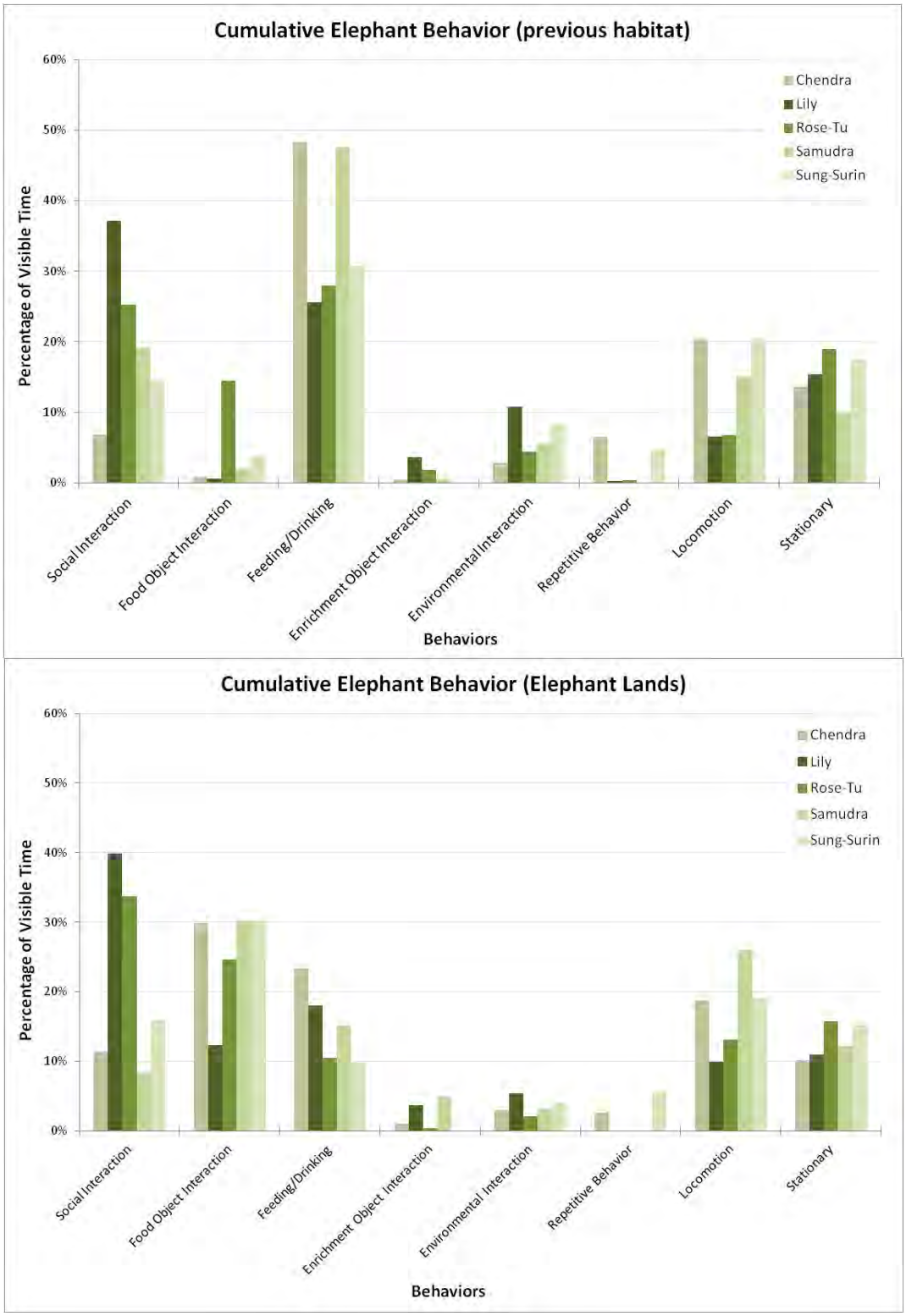


Figure 6: Cumulative behaviors in the previous elephant habitat and in Elephant Land.

The percentage of time performing social behaviors has increased (average 4% increase) for all individuals with the exception of Samudra (Figure 7 and 8), whereas the percentage of time spent in proximity of other elephants decreased (average 24% decrease) in Elephant Lands as compared to the previous habitat (Figure 8A). These findings indicate increased choice and control over whom they spend time with and how they interact socially.

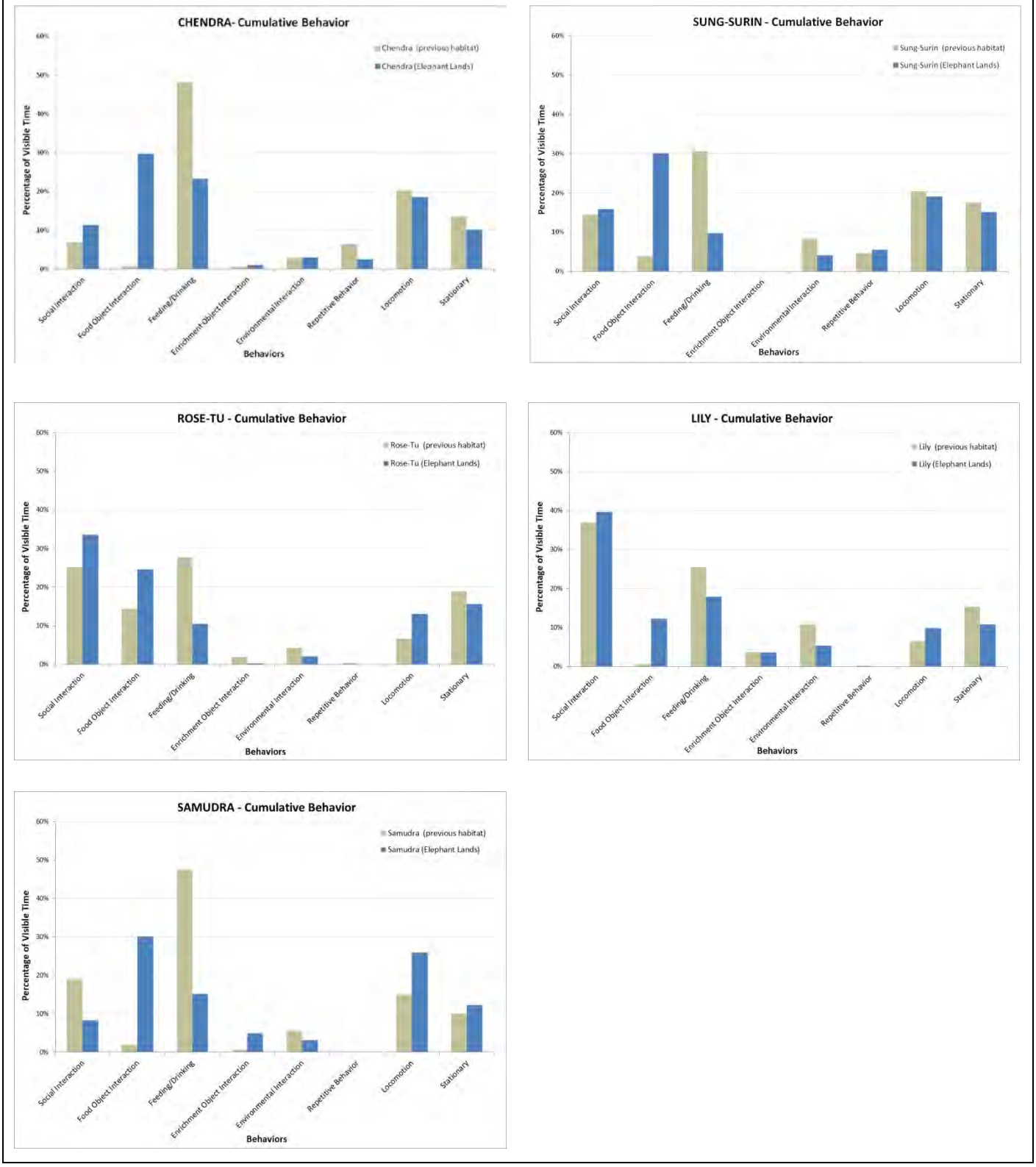


Figure 7: Cumulative behaviors for individual elephants comparing the percentage of time performing the behaviors between the previous habitat and Elephant Lands.

Chendra switched from spending negligible time interacting with food objects to foraging actively and eating food items (almost 30% increase) distributed in various ways throughout Elephant lands. However, she still also spends a large portion of her time feeding from food that is available without object manipulation, such as live vegetation, browse and hay left by other elephants near food-delivery features. Performing any repetitive behaviors has decreased in Elephant Lands from about 7% of her time to less than 3% of her time.

Sung-Surin switched to feeding primarily from items that distribute food in Elephant lands (26% increase), but learning this strategy was more challenging and took longer than it did for the other elephants. During the first several weeks, she spent time near gates in anticipation of keepers delivering hay rather than exploring. Keepers attempted to "teach" her to eat out of the feeders by calling her to the feeders, which may have unintentionally prolonged the transition. She shows few repetitive behaviors (less than 6% of her time) in the previous habitat and in Elephant Lands, and such behaviors occurred in infrequent bouts, potentially related to anticipation since she was still linking keeper staff with food and was initially reluctant to actively seek food items throughout the habitat. We saw a marked decrease in repetitive behavior as she began to understand that she needed to seek food on her own rather than wait for staff.

In contrast to the GPS monitoring results, behavior results indicated the amount of time spent in locomotion is not significantly different in the two habitats for Sung-Surin and Chendra, which may be due to the different sampling frequencies and measuring techniques. Behavior observations were conducted only during zoo hours and were recorded for 2-minute intervals (see methods), whereas GPS data was collected every 5 seconds for 24 hours. In addition, behavior methods categorized locomotion while feeding as a Feeding behavior, so walking and feeding is not included in the Locomotion behavior category. The GPS data is therefore a more reliable representation for overall movement and walking distance in this case.

Rose-Tu switched to feeding primarily from items that distribute food in Elephant lands (10% increase); however, in the previous habitat she already spent more time manipulating food objects than any of the other elephants so the increase for her is not as drastic. Rose-Tu shows an increase in social interactions (8.5% increase). Locomotion increased in Elephant Lands (6% increase) and time spent stationary decreased (3% decrease). Rose-Tu shows no repetitive behaviors in Elephant lands and showed less than 1% of her time in repetitive behaviors in the previous habitat.

Lily quickly learned to seek food from a diversity of feeding methods in Elephant Lands. She adapted most readily to the new habitat. Locomotion increased (3.5% increase) in Elephant Lands and time spent stationary decreased (4.5%). Lily shows no repetitive behaviors.

Samudra learned to seek food from a diversity of feeding methods in Elephant Lands and his food object interactions were minimal in the previous habitat. Locomotion has increased in Elephant Lands (4% increase), suggesting increased foraging and exploration. Samudra shows no repetitive behaviors. Social interactions for Samudra have decreased in Elephant Lands (by 10.5%), but this is related more to his development as an adolescent male and his role in the herd. In addition, management of a maturing bull necessitates temporary separation from related females during their female reproductive (estrous) cycle.

In general, the percentage of time spent in proximity of other elephants decreased (average 24% decrease) in Elephant Lands as compared to the previous habitat (Figure 8A), reflecting the individuals' choice within the same habitat of whether to spend time near other elephants or farther away.

For Samudra, the decrease was dramatic (Figure 8A), which is partly due to his development as an adolescent male and his role in the herd. For Lily, this decrease also reflects normal social development in young elephants in that she is spending less time near her mother and more time with other elephants (Figure 8C). In wild elephants, the distance between calves and mothers increases gradually with age (Sukumar, 2003), so these changes in proximity reflect natural behavior in social development.

Interestingly, Chendra's overall proximity to other elephants and her social interactions increased in the new habitat (both by 5%), but the herd-mates with whom she spends the most time are opposite from that in the previous habitat (Figure 8D). In the previous habitat, Chendra was often displaced from an area or activity by Sung-Surin, whereas in Elephant Lands she can choose to move somewhere else to engage in an activity of choice, again showing more choice and control over environment and a more equitable social environment for this individual.

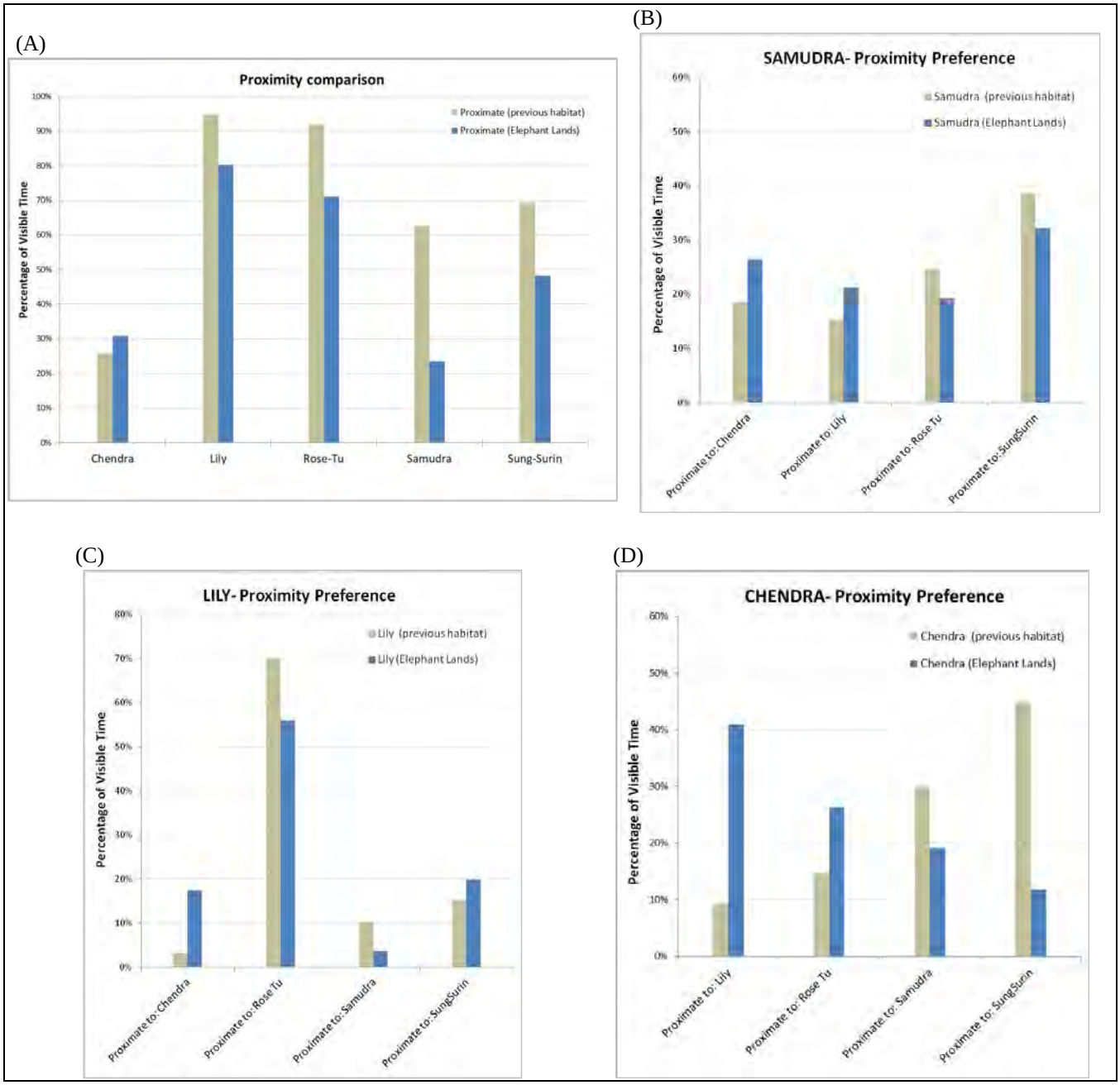


Figure 8: Proximity for individual elephants comparing the percentage of time in proximity to herd mates between the previous habitat and Elephant Lands (A), and change in preference for herd mates exhibited by Samudra (B), Lily (C), and Chendra (D).

In general, the elephants are choosing to utilize the entire habitat, with two areas used less frequently for passing through or for temporary holding while staff is cleaning. The usage of North Meadow and Forest Hall varies more among individuals, while the South Habitat and Encounters West usage is more consistent.

The elephants manipulate their environment more by pulling, pushing, kneeling, stretching, etc., to obtain food items or to move objects for other reasons (including play behavior). The proportion of time spent in Elephant Lands seeking food and feeding is much higher (34% higher) than for enrichment and environmental interaction in a non-social context, so behaviors of interacting with enrichment objects and environmental features are more rare, and with our sampling methods both the behavior and these resources may be underestimated. In addition, the frequency of behaviors presented for interacting with enrichment and environment does not account for these interactions when they also involve sharing of resources in a social context (e.g., sharing food, playing with another elephant in the pool, playing with an enrichment object). The observed resource use (Figure 9) shows the proportion of time spent using each resource in a non-social context, highlighting the diversity of resources available and how they are used when elephants are not interacting socially.

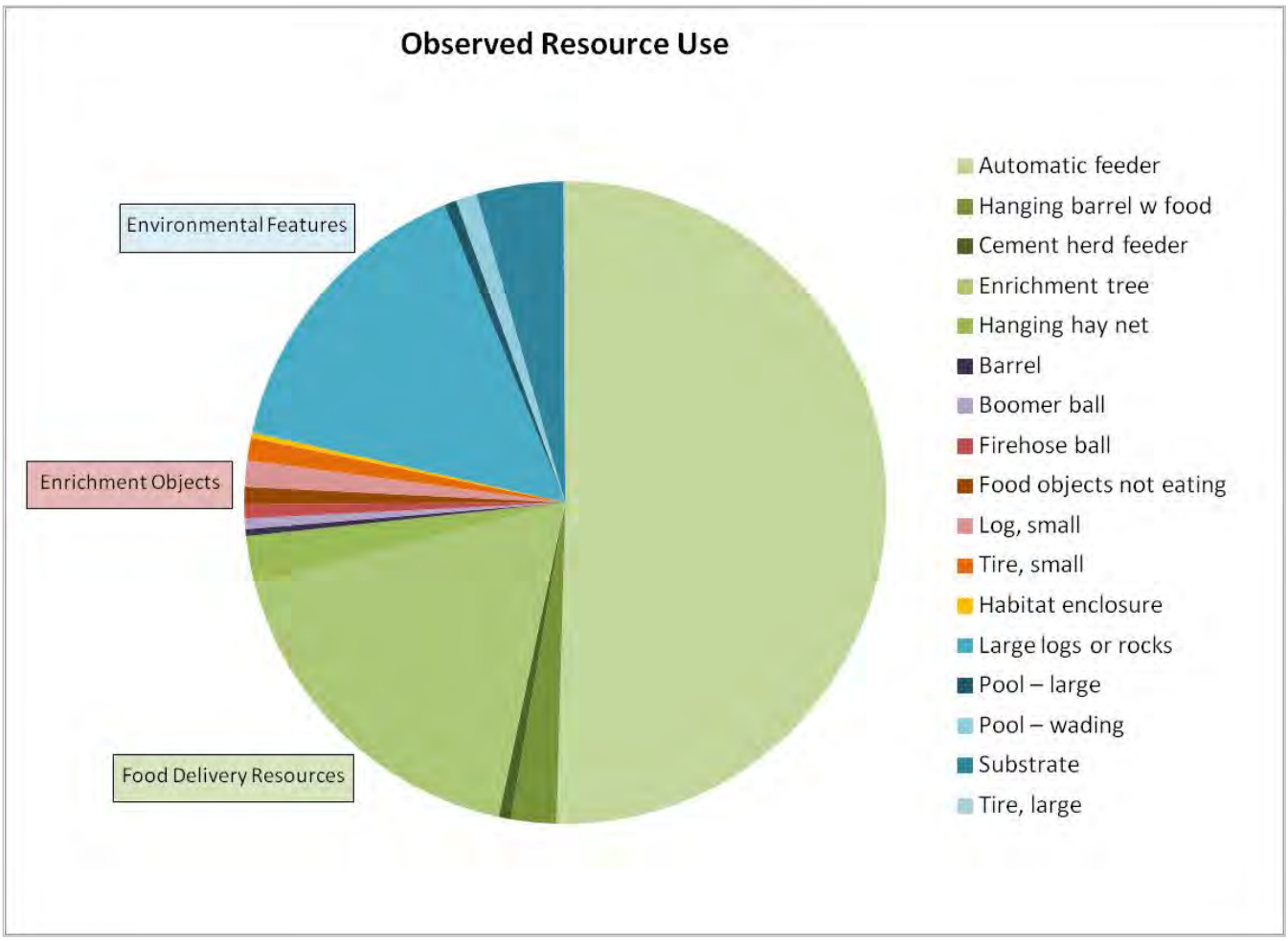


Figure 9: Observed resource use in Elephant Lands

Summary Points on Behavior Measurements:

- Behavior was measured in the previous elephant area, during the period of major change, and the first year in Elephant Lands.
- Results of behavior measurements show increased activity, increased foraging, and increased choice and control over their environment, with whom they spend time, and how they interact socially.
- In Elephant Lands, the elephants spend the majority of their time socializing and interacting with their environment in a social context (22%), seeking food and feeding (40%), moving and resting (20%).
- The elephants are exhibiting a diverse range of natural behaviors and social dynamics of a healthy herd.
- Behavior methods developed for this study are being used in ongoing elephant behavior monitoring.

Summary

The Oregon Zoo has pioneered elephant care for decades, and has collected, documented and shared information with colleagues around the world. Results of this welfare study show that the zoo has achieved its goals with Elephant Lands. The elephants are more active, they are exhibiting more choice and self-determination, they are expressing a diverse range of species-typical behaviors, and they have biologically meaningful challenges. We will continue long-term scientific monitoring of the herd, which will inform fine-tuning of the habitat to maximize elephant welfare. The ultimate aim is that each elephant can exhibit a full range of natural behaviors, living in a socially stable, multi-generational matrilineal herd that is regularly integrated with bull elephants in a manner that meets or exceeds their biological, social, physiological and psychological needs. The zoo is immensely grateful for the support of this community, for helping advance the welfare of the elephants entrusted to its care.

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Oregon Zoo Bond Citizens' Oversight Committee Meeting
May 9, 2018
Agenda item H

Date: May 3, 2018
To: Oregon Zoo Bond Citizens' Oversight Committee
From: Don Moore, Oregon Zoo Director
Subject: **Elephant Lands Year 1 Operating Results**

The Oregon Zoo Bond Citizens' Oversight Committee requested that zoo staff evaluate the operations of Elephant Lands, identifying challenges, highlights and lessons learned. The zoo team focused their evaluation on internal operations and management of visitor, animal, and staff spaces. Now, with two years of experience, zoo personnel are able to evaluate its operation with an eye to informing the design of future facilities.

The zoo has gone through significant leadership and management changes and the modern global zoo profession has changed management requirements since Elephant Lands was envisioned. These local and global changes have influenced current decisions around how spaces are used. Overall, the new space works well. Following an initial steep learning curve and supported by training, staff learned to effectively manage the new facilities and to leverage more creative education and food service opportunities. There has been a small staffing increase to manage the new mechanical and electrical systems.

Broadly, while water consumption has decreased due to modern filtration systems, energy consumption has increased due to overall square-footage expansion and operating practices in Elephant Lands. This needs to be taken in context with the totality of increased zoo project investments to conserve water and energy, along with the zoo's purchase of 100% renewable power.

Key lessons learned:

1. Design for flexibility, as operating needs change over the life of the facility.
2. Enhanced training and a well-organized hand off from the zoo bond team to the zoo operations team pays off, facilitating a smooth transition in ownership and management.
3. Create better systems to ensure preventive maintenance that extends the life of buildings and systems, thus reducing costs over the long-term.
4. New sophisticated technical systems require skilled operation and must be managed by staff with appropriate training and expertise.
5. While value engineering is essential to bring projects within budget, it is important to consider the long-term management and maintenance challenges and costs that may result from cuts or alterations in individual project features and to weigh and account for cumulative impacts from these decisions across the zoo and through the overall multi-project bond program.

Animal care

Elephant Lands was designed to support the natural dynamics of our Asian elephant herd. The new habitat exemplifies the Oregon Zoo's philosophy that all animals should have the opportunity to exert choice and self-determination. Using information gathered through more than 60 years of work with Asian elephants, the zoo made every effort to view the world from an elephant's perspective and looked at the new habitat through their eyes to the extent that humans are able.

Elephant Lands spans six acres and its shape and topographical complexity encourage exploration and activity — the elephants cannot see the entire space from any one vantage point and get exercise simply by maneuvering through it. The habitat's flexibility allows elephants to make decisions about where and how they spend their time and who they spend it with. The perimeter walking distance is more than 1.3 miles and the hilly terrain, various climbing features, and deep sand provide stimulation and physical challenges. A 160,000-gallon pool allows the entire herd to swim together if they choose. Other water features include a wading pool, drinkers and a water cannon that can be used to make a mud wallow.

When the elephants want to find food, water or shelter, they have to actively look for it. To encourage this foraging behavior, the zoo placed 25 feeding stations throughout the habitats, ranging from timed feeders that release food at programmable intervals, to overhead boom feeders and large concrete herd feeders that are randomized daily. Inside Forest Hall, an activity tree features two hay feeders, a drinker, a timed feeder and mesh boxes with food items for elephants to explore. Food items can also be hung from a hoist system and moved around the indoor space. An elephant may explore one area of the habitat and find no food, only to return an hour later and find a small snack or even a "buffet."

The arrival of Samson, the zoo's new male elephant, highlighted the efficient design and smooth function of the load-in area. Its features save time when it counts and helps reduce stress on both the animal and staff.

The new design has supported the full-scale implementation of the zoo's welfare-based training system. This system optimizes the care for each individual animal and allows the zoo's elephant care team to provide all of the elephants entrusted to our care the highest level of welfare possible. Elephant Lands was specifically designed for this system and has allowed the zoo to meet or exceed all recommended husbandry and veterinary procedures outlined in the *Principles of Elephant Management* manual and the Association of Zoos and Aquarium's *Minimum Standards for Captive Elephants* while also ensuring consistency, regardless of the staff member administering the training.

The original plan called for five keepers covering nine hours per day, seven days per week and is working as expected. At the time the plan was created, there were eight elephants to care for and now there are five. However, healthcare protocols have also been updated, requiring additional staff time. The larger spaces with fewer management options allow elephant choice and also require more staff time.

Guest Amenities

Elephant Lands includes a number of features that add to the comfort and enjoyment of a zoo visit including seating areas, restrooms and food service locations.

<u>Catering and food service</u>

Forest Hall, Elephant Plaza and Discovery Bridge were envisioned as venues for catered events. This has proved less successful than anticipated. Forest Hall is difficult to service and problematic due to health code regulations that address food served in proximity to open-animal enclosures. In warm weather,

Elephant Plaza proves less than ideal given its asphalt base, lack of shade and congestion from regular zoo visitors. Discovery Bridge has yet to be catered, but its possibilities will be explored in the future.

Despite these setbacks, the zoo team created opportunities to leverage the new facilities. Local food cart vendors now showcase their businesses and culinary creations in Elephant Plaza. In this way, the Oregon Zoo contributes to the local economy, increases revenue and provides visitors with more diverse food offerings.

Retail

Working with our souvenir retailer, Event Network, zoo staff reviewed a number of potential locations and chose to place an outlet at the top of the concert lawn. The location was large enough to accommodate guests viewing Elephant Lands and is highly visible to guests during concerts. It was designed to not detract from the look of the exhibit when closed. The shop's hours are based on weather and visitor numbers. Event Network and the zoo are pleased with returns from the location, noting increased per capita spending both daily and during concerts.

Restrooms

Before Elephant Lands was built, the zoo had no family restrooms or designated nursing stations. The all-user restrooms and a modern nursing room were an important addition to Elephant Plaza. These restrooms are well used and will be included in future project designs. There are also restrooms available within Forest Hall.

Train

The on-grounds train route was reconfigured and shortened to accommodate the expanded elephant habitat. The new train route provides a view of elephants in the North Meadow habitat and, when Polar Passage opens in 2020, will provide a view of polar bears as well. Recorded interpretation was added and additional enhancements to the route are made during ZooLights, providing a positive experience for guests.

Concerts

The Elephant Lands design integrated improvements to the concert area. Infrastructure was added to accommodate more food carts. There are now more viewing areas, including the bridge. Today, the concert audience is surrounded by Elephant Lands and the entire area is more open and natural. This has enhanced the concert experience dramatically. In addition, lighting was improved, restrooms were added and the whole area was cleaned up, giving the venue a much better feel.

Previous sellable capacity at premium concerts was 3,800 with approximately 100 complimentary tickets (comps). We now sell 3,800 tickets and have 200 comps so overall sellable capacity is the same. However, concert ticket sales have increased since Elephant Lands opened and while this can't be directly attributed to the new habitat, the zoo has received positive comments on the beautiful venue.

Education
Forest Hall serves many functions. It is an inviting space where visitors can retreat from the weather and pause during a busy zoo visit. Here visitors get an up-close view of the elephants while learning about the 5,000-year history of the human-elephant relationship around the world. They gain a different, more intimate and profound experience of the animals through visuals, sound and even odor than they can outdoors. This is where they fully grasp the scale of these animals. Given the few options across the zoo campus to get out of the weather, Forest Hall provides an inviting space to warm up, dry off and have a snack and, perhaps most important, linger and contemplate. The space feels good and people chat with each other, relax and often stay for quite some time. While this was the intent during design, the facility has proved even more welcoming and comforting than envisioned.

Keeper talks are given daily at Elephant Lands and are extremely popular. They occur at the pool during warm months and in Forest Hall during the cooler months. The pool area is much more popular than anticipated and the installed speaker system has proved inadequate to meet the needs of the gathered crowds. It can be modified by hanging the speakers from nearby buildings so they are above the visitors. This sound-projection need has been noted and will be integrated into plans for the final bond projects.

Interpretive talks are also presented by volunteers. In 2016, there were 568 hours of talks by Zoo Guides and 1078 hours by Zoo Teens.

For a full assessment of the success of interpretive design and messaging, see *Oregon Zoo Elephant Lands Summative Evaluation Report, May 2017*.

Camps
Of the seven day camps offered during Winter Break 2015, "Elephant Empire" was the most popular and all four age levels spent significant time exploring the new exhibits and learning from keepers during a specially scheduled enrichment in Forest Hall. Ninety-nine campers participated.

Summer Camp 2016 offered two different styles of camps – week long camps and day long discovery camps. "Extraordinary Elephants" as a day camp was offered three times during the summer and was the most popular, with the highest total numbers of campers per day and 281 participants in all. Week-long camps regularly featured Elephant Lands on tours and used the interpretive carts with various ages of campers, particularly the upper levels. In 2016, 2,670 campers participated in week-long camps. Zoo Snooze overnight camps have not been launched at Elephant Lands.

Physical operation
In order to properly maintain Elephant Lands' new mechanical and electrical systems, the zoo's Facilities Division added resources and acquired technical knowledge. The zoo added a new position--controls engineer--to handle the complex building automation systems. The zoo increased training for the life support system team and has benefitted from using a computerized maintenance management system to record our assets and to track preventive maintenance and work orders for those assets. Adding a control engineer to our staff has allowed us to tune up operation of life support systems and modify some processes to save energy.

The Facilities team and Bond Program team today work collaboratively, taking lessons learned from Elephant Lands and other recent construction and applying them to the Education Center and remaining bond-funded projects. The Elephant Lands hand-off helped the zoo recognize the need to anticipate and

plan for this transition in facility ownership, and for the zoo operations team to gear up to take on new and sometimes challenging responsibilities. This includes things like developing a training process on how building automation controls operate. Knowledge gained on the Elephant Lands life support system helped with design of Polar Passage. The zoo is establishing preventive maintenance practices to ensure that we optimize the life cycle cost of buildings and systems.

The automated building controls not only require more sophisticated maintenance, they require that keeper staff change their methods of operation. Many of these systems were designed to operate automatically and both keepers and facilities staff are learning that altering their operation may bring on unintended results. Zoo teams continue to adjust operation to meet energy and animal care goals.

The zoo has recognized the value of standardizing equipment across the zoo in new projects and in the replacement of assets. One example is a shift from remote controlled doors to a manual access system, improving safety and reducing maintenance costs.

We select and monitor the chemicals and measure by-products in our life support systems to ensure a sustainable, healthy environment for our animals and staff, as well as extend the life of our equipment by reducing the need for corrective maintenance and early replacement. The Life Support System department has increased annual monitoring and computerized testing of water systems. The team is also scheduling preventative maintenance pool water changes and adjusting practices when needed.

Throughout Elephant Lands, the natural substrates include a specific sand type (USGA top dressing) that cushions the elephants' feet and allows for drainage. Sand has been replaced in the stalls and needs to be supplemented in the yards to make up for compaction, loss from cleaning and tracking into the pool systems. The main pool is being put on an annual cleaning schedule to remove sand before it causes circulation issues. The sand base eliminates the need for bedding material. The zoo saves both materials and time and there is a dramatic decrease in organic material transported to the zoo's composting facility.

Landscape maintenance

The landscaped areas around the old elephant exhibit were made up primarily of established mature vegetation and lawns. Most of the elk meadow was pruned and mowed by the elk. The path that wound up and around the knoll and served as a route for temporary exhibits (e.g., Dinos) was fenced off prior to construction. Under these conditions, the overall landscaping required only a modest amount of labor to maintain.

Elephant Lands landscaping design called for a grassy, flowery buffer between the visitor barrier and the habitat fence and native plantings in surrounding areas. Maintenance of these two vegetation types has proved more labor intensive than anticipated. The seed mix used in the buffer included an alfalfa that grew exuberantly and has established itself as a monoculture, dominating the site. Managing it requires manual trimming with a weed eater. This activity must be coordinated with the animal care staff, greatly diminishing the efficiency of maintenance time.

In the ideal, quality top soil is skimmed at the beginning of construction, stored and then reused or a balanced garden soil mix is brought into a site following construction to provide a healthy medium for establishing new vegetation. As part of value engineering, the landscaping budget was reduced by creating a mix using two parts site soil to one part zoo doo. Some site soils are heavy clay that drain poorly. While the added organic material is helpful, it breaks down over time and does not provide an

adequate or permanent amendment to improve heavy soils. The soil pH is out of balance. Poor aeration and drainage have made it challenging to establish native plants, especially perennials and shrubs that take several seasons to build the mycorrhizal fungi in the root zone necessary for uptake of nutrients.

In retrospect and for future projects, the zoo's Horticulture staff would request design specs call for a quality garden soil mix in landscaped areas. At this time, staff are removing and replacing the alfalfa mix and replacing natives with hardy plants that can tolerate heavier soils.

Water and energy savings

As part of its vision for a better future for wildlife, the Oregon Zoo is committed to sustainable operations, and sustainability was promised in the 2008 bond measure. Elephant Lands was constructed with a number of sustainable features.

The pools at Elephant Lands are on target to use 86 percent less water than the old pools. This is a decrease of more than 13 million gallons of water annually. Water use and conservation are being managed by the automated backwash recovery system. Pool cleaning and complete water replacement has been put on a once-per-year schedule. The previous elephant pool system had no filtration and was regularly dumped and filled.

Rainwater collected from Forest Hall's roof is stored in a 5,000-gallon underground cistern, reducing peak loads on the city stormwater system and conserving potable water that is used in Forest Hall for flushing toilets and habitat wash-down.

Although the buildings and life support systems were designed to maximize energy savings, evolving animal management practices have decreased the effectiveness of some of the energy-saving measures. Staff have modified the sequence of operation, shutting down systems during low use times (night) which saves a significant amount of energy. This practice was tested this fall and is now in place. It will continue to be evaluated during the heavy use season and results will be compared. We expect this to be successful and will replicate it in Polar Passage.

Several problems arose with management of the heating sensors in the shade structures. Animal staff elected to operate them continuously, resulting in an increased energy load. Staff are testing modifications to the equipment and to animal management to limit their operation when animals are not present.

An innovative geothermal system was installed during construction of Elephant Lands and will be connected and put into operation during construction of Polar Passage. Heat that results from cooling polar bear swimming pools will be directed through rows of slinky-like coiled pipes buried eight to twelve feet under Elephant Lands North Habitat and used to warm Forest Hall.

The solar photovoltaic array on Forest Hall's roof generates around 34,000 kilowatt-hours a year. A solar hot-water system preheats water for elephant bathing and other uses, storing it in a 1,500-gallon tank in the building's mechanical room.

Large louvers on the walls and roof of the indoor facility open automatically based on outdoor temperatures. This allows natural ventilation and, when triggered, reduces the energy needed for fans by about 75 percent.

Conclusion

The Oregon Zoo has received sixteen honors and awards for Elephant Lands to date and the new habitat far exceeded the community's expectations. That said, the zoo places great value on examining its achievements and practices for areas that can be improved.

It is important to be realistic and conservative when making projections based on new facilities. For example, it was projected that Elephant Lands would increase attendance in the first year by 200,000 visitors with a commensurate $2 million increase in revenue for that year. However, the zoo did not experience any noticeable increase in attendance due to the exhibit opening.

To the extent possible, it is essential that the zoo fully consider all ramifications of operating new systems. This requires a multidisciplinary approach to planning and there is value in hearing concerns from staff and managers with different perspectives. These need to be fully vetted during design.

The zoo has achieved significant reductions in water consumption which was a major goal of the bond program. It is important to recognize that some of the features that achieve water conservation require significant energy to operate. It is also important to fully consider the functional operation of new systems to make sure they will meet energy goals and are a good fit with the needs of a zoo. New systems may need additional or different staffing.

As the zoo completes designs for the final three bond-funded projects, and anticipates designing the second half of projects identified in its campus master plan, it will apply the lessons learned from Elephant Lands. Certainly one major take-away is a recognition that leadership, animal populations, priorities, needs and standards for best practices can all change over time, so it is important to design for flexibility.