

From: [Chuck Flaherty](#)
To: [WPCtestimony](#)
Subject: Re: GP2045, late written testimony plus attachments
Date: Friday, November 1, 2024 12:00:18 PM
Attachments: [GP2040, Aug. 2019 draft, Public Access thru Cultural&Historic Preservation.pdf](#)
[Scenario Planning - Trend Scenario Land Use Allocation Technical Report - Placeways \(2016\).pdf](#)
[Technical Methodology for General Plan Land Use \(2020-24\), 8-23-24.pdf](#)

Aloha Mr. Chair and members of the Commission,

Kala mai for not getting my written testimony to you prior to the meeting.

Please see testimony below and attached documents to which I was referring in my testimony that have been a part of the General Plan Comprehensive Review process and should have been provided to the Commission, as well as the public.

Documents attached to this e-mail:

- Draft General Plan 2040, pages 102-125
- Trend Scenario and Land Use Allocation Technical Report
- Technical Methodology for General Plan Land Use (2020-2024)

Because of the large size of the documents, I will have to send the Scenic Resources Inventory and Mapping Project report and an e-mail to immediately follow this one.

Mahalo,

Chuck Flaherty

November 1, 2024

Windward Planning Commission

101 Pauahi St, Ste 103

Hilo HI 96720

Re: Final draft General Plan 2045

Aloha Mr. Chair and members of the Windward Planning Commission,

My name is Chuck Flaherty. I am speaking on my personal behalf today.

Mahalo nui loa for your volunteer service on this Commission. This special meeting and agenda item should have been given more time.

If you have read the draft GP2045, then we now have had a shared experience of

attempting to compare it to the current General Plan. The feedback that I've gotten from other members of the public is that this comparison has been an almost impossible task because GP2045 is a complete gut-and-replace of the current General Plan. Also, placing the GP2045 online in two different software platforms has disenfranchised a large number of people who have made sincere efforts to make informed comments, but are technologically-challenged.

As a general statement, the draft GP2045 does not contain sufficient imperative and directive language to provide reasonable assurance that it will be implemented.

That being said, there are documents that are relevant to the draft General Plan that should have been provided to the Commission. It may be that these documents are the ones that have been submitted today, but I will review the list with you to make sure. I've also attached them to this e-mail so they may be forwarded to the Commission's members.

The most important of the documents not provided to the Commission is the draft General Plan 2040 that was released in August 2019 by then-Planning Director Michael Yee.

The reason GP2040 is so important is because it shows the extent to which public access and cultural, historic, and scenic resource preservation policies and actions contained within GP2040 were removed and not included in GP2045. For instance, the Sustainability Objective on page 108 states,

"Native Hawaiian language, values, and practices are integrated into all County processes." This objective has been cleansed from the draft GP now before the Commission.

Another document is a report titled "Hawai'i County Scenic Resources Inventory and Mapping Project, Scenic Resource Protection Programs and Strategies" prepared for the Planning Department in August 2016. The Policies and Actions in GP2040 included the programs and strategies recommended by this report. However, GP2045 removed these policies and actions and now GP2045 only contains a reference to the report.

Another report not in the Commission's initial board packet is the Trend Scenario and Land Use Allocation Technical Report, published in April 2016. This report contains important information, such as how many dwellings can be built with existing zoning, subdivision approvals, and building permits.

Another critical report not included in the Commission's initial board packet is the Technical Methodology for General Plan Land Use (2020-2024). This report was not released until August 2024. It should have been released a year earlier because it contains information that the public has been requesting since last September 2023, such as explanations of how the GP2045 land use maps were developed.

I would like to give an example of why General Plan land use designations are so

important. Let's use the example of a property owner who wants to rezone and subdivide 300 acres in the state land use Agriculture district. If the property owner applies to rezone and subdivide for Ag-1 lots, the owner could be granted approvals. Now let's say the property owner wants to subsequently have the subdivision moved to the state land use Rural district, so that amenities, such as a members' lodge, could be built. The owner would have to file a petition with the state Land Use Commission (LUC) for boundary amendment and the petition would go before the LUC for consideration. And let's say the owner asks the county to use the general plan comprehensive review process to redesignate the subdivision from Agricultural to Rural in the GP land use map and let's say the county makes the change in the GP land use map. Because the individual lots in the subdivision are Ag-1, that is, less than 15 acres, the state LUC would no longer have jurisdiction and individual land owners could then petition the county to have their lot(s) redesignated from the state land use Agriculture district to Rural and also apply for county rezoning to Rural as well.

The bottom line is that while the project owner cannot request a state land use boundary amendment involving more than 15 acres because the Planning Director would have redesignated the GP land use map to Rural for all lots in the project's subdivision, the individual lot owner(s) can apply to the county have their 1 acre lots redesignated to the state land use Rural district and apply for county rezoning to Rural in order to accrue the ability to have expanded property rights and uses on their lots.

Presently, the Planning Director is refusing to provide the reason that he is proposing such changes to the GP land use map.

Mahalo,

Chuck Flaherty

Captain Cook

PROMOTING ACTIVE LIVING THROUGH RECREATION, TRAILS, & PUBLIC ACCESS

Public Access & Trails

SUSTAINABILITY OBJECTIVE

Number of public access sites created through acquisition or easement or enhanced with assistance from CZM funding or staff.

POLICY

404. The County of Hawai'i shall establish: public access to and along the shoreline to significant historic sites, public transit along the top of cliff, streams and other natural water courses, mauka trails, facilities, and access to sites for gathering, hunting, and other recreational purposes and in accordance with Hawai'i County Code Chapter 34. [Rationale: Based on existing County Code 34, General Plan Policy 12.3 (l, m), Ka'u CDP Policy 81, and Hāmākua CDP Policy 48]
405. Subdividers of six or more lots, parcels, units, or interests shall be required to dedicate land for public access for pedestrian travel from a public highway or street to the land below the high-water mark on any coastal shoreline or to areas in the mountains where there are existing facilities for hiking, hunting, fruit-picking, ti leaf sliding, and other recreational purposes, and where there are existing mountain trails. [Rationale: Based on existing HRS 46-6.5 and HCC 34-4(c).]
406. Prior to disposing of, leasing, or transferring public lands, including public roads or trails, public access potentials shall be assessed, documented and protected if public access use is in the public's interest. [Rationale: Based on existing HRS Section 46-1.5, Hāmākua CDP Policy 50, and General Plan 12.3 (n).]
407. Ensure that publicly owned historic trails and roads are properly identified, and consultation occurs to protect the public's interests. [Rationale: Based on the Highways Act of 1892, Hāmākua CDP Policy 50, and the General Plan 12.3 (n).]
408. Alignment of coastal trails shall consider flexibility for realignment for sea level rise and other dynamic shoreline changes. [Climate Change]
[Rationale: Based on current status of some impacted coastal areas and research relating

to projected sea level rise impacts on coastal assets. See also California Coastal Commission Sea Level Rise Policy Guidance.]

409. Determine the location and ownership of historic trails and roads as early as possible in the land use application process.

[Rationale: Based on identified challenges with ownership of historic trails and roads and the subsequent legal implications. See also General Plan Policy 13.2.3 (q)]

410. Where a subdivision is traversed by a natural water course, drainage way, channel, or stream, the Planning Director should require a pedestrian, equestrian, and/or bicycle path when the opportunity exists to connect to existing or future drainage or trail corridors.

411. Trails may also be used as emergency access routes, where appropriate.

412. Support the development of a Rails to Trails type program to facilitate the conversion of old railway segments to a public trail network.

413. Seek private-public partnerships to manage and maintain public access to the shoreline, public trails, hunting areas, scenic places and vistas, and significant historic sites, buildings, and objects of public interest. [Public Access]

414. Explore options and collaborate with community groups to increase access to former sugar cane roads to be used as non-motorized trails where feasible and appropriate.

ACTION

- 4.49 Amend code to require bicycle and walking path easements be developed in urban areas to increase walkability and multimodal transportation options. [Code]
- 4.50 Work with the State and adjacent landowners in establishing old railroad right-of-ways as pedestrian and bicycle trails.
- 4.51 Identify by GPS coordinates all existing historic trail alignments that (a) have been recommended for preservation by SHPD, (b) appear on historic maps and/or are known by oral tradition, and incorporate these into the County GIS database.
- 4.52 Actively implement the Ala Kahakai National Historic Trail Memorandum of Understanding.
- 4.53 Appropriate, finance, allot, and encumber Capital Improvement Projects in support of trail development as part of a regional trail system.
- 4.54 Add public access requirements as listed in Hawai'i County Code Chapter 34 Public Access to apply to Chapter 23 Subdivision Code, SMA review, zoning code, special permits, etc. [Code]

- 4.55 Develop and implement a public-private program to establish and manage specific access points and trails.

SUSTAINABILITY OBJECTIVE

Develop and maintain a public access program that integrates recreation, subsistence, and cultural access priorities.

POLICY

415. Integrate Public Access into County department priorities in the following ways:
- a) Incorporate public access and development into a program overseen by the Planning Department as per Chapter 34.
 - b) Integrate PONC property management and maintenance into the Parks and Recreation code in Chapter 2: Article 11 and Chapter 15: Parks and Recreation.
 - c) Develop adequate staff to carry out the provisions of Chapter 2 Article 42, relating to the PONC maintenance fund (as per: Section 2-214.2 (b). Pursuant to section 10-16(c) of the Charter, the maintenance fund shall be administered and managed by the department of parks and recreation. Adequate staff to carry out the provisions of this article and section 10-16 of the Charter shall be provided in the department of parks and recreation.

[Rationale: Based on identified gaps in addressing or applying public access regulations and procedures consistently between the various County Departments. The County lacks capacity to fulfill its existing public access objectives without increasing staff capacity, maintenance capacity, and without having clearer directives between the various departments to implement a cohesive public access program.]

416. Integrate County public access priorities in all aspects of land use decisions and permit reviews.
417. Consistently integrate public access development and maintenance into Parks and Recreation department priorities.
418. Support facility development for access management at access points and along trail corridors.

ACTION

- 4.56 Establish a County of Hawai'i Public Access and Trail Program with sufficient staff and resources. Staff will be required to consult/consider recommendations of this program in all permit reviews. Elements of this program may include:

- a) A comprehensive access inventory;
- b) A public access rating system to help with prioritization;
- c) Comprehensive reviews of projects (on public or private lands) that will affect public accesses and trails;
- d) Inventory of ancient trails, cart roads, and old government roads in coordination with appropriate State agencies.
- e) Public outreach and coordination element.
- f) Identify agencies/groups to develop, administer, and maintain public accesses, including developing County capacity for this purpose;
- g) Identify funding sources to purchase and manage public access easement to priority areas;
- h) When public access goals will involve several landowners, acquire the public access incrementally as opportunities arise to do so;
- i) Public accesses that cross private land will be acquired and held until appropriate management of the accesses is in place;
- j) Collaborate with State and Federal agencies on public accesses that require multi-agency involvement;
- k) Develop a standardized template to promote consistency and comprehensiveness in the public access plans required by landowners;
- l) Partner with community organizations capable of assisting with public access management;
- m) Work with State agencies (particularly with DOFAW) to coordinate, survey, develop, and manage public trails and roads leading to forest reserves;
- n) In co-sponsorship with the State when possible, acquire land for public access to historic sites and objects and to the shoreline where safe transit does not already exist;
- o) Reinstitute a Public Access Wayfinding program managed by the Planning Department to assist interested community groups in maintaining appropriate signage at public access points;
- p) Provide cultural and safety information at trailheads;
- q) Provide for substantive community input to the County Planning Department and the County Council in order to finalize and accept priority access. Include community input in program policy.
- r) Whenever the County assumes the responsibility for posting and maintaining signage and maintaining public accesses and other public infrastructure, a specific County agency will be identified and assigned the aforementioned responsibilities. [Code, Public Access]

- 4.57 Amend the subdivision code to better address public access issues in the following ways:
- a) Revise/Develop enforcement protocols for public access violations, including fines for noncompliance and mechanisms to remove private obstructions from public accesses;
 - b) Review Hawai'i County Code Chapter 34 requirements for public access standards, including design that fits into surrounding community, environment, and conditions. Establish parameters for requiring appropriate right-of-way, parking, and comfort stations for various types of public accesses/trails and incorporate these into Chapter 34;
 - c) Amend Hawai'i County Code Chapter 34 to develop a clear methodology to modify public access routes in order to adapt to sea level rise, landslides and erosion, and other impacts related to environmental impacts and climate change;
 - d) Amend Hawai'i County Code Chapter 34, Rule 21, Chapter 23, and Chapter 25 CA 1.1.1 to ensure access and trail rights-of-way during subdivision. [Code]
- 4.58 Complete an inventory and database of significant natural resource areas with recreational and trail connectivity value.
- 4.59 Adopt an on-going program of identification, designation, and acquisition of areas with existing or potential recreational resources, such as land with sandy beaches and other prime areas for shoreline recreation in cooperation with appropriate governmental agencies.
- 4.60 Develop procedural rules and templates for public access agreements and Grant of Easement (GOE) to facilitate consistency and to provide mechanisms for tracking, follow-through, and geographic information system (GIS) identification in County of Hawai'i systems, etc.
- 4.61 Develop procedural guidelines for renegotiating access agreements.
- 4.62 Renegotiate public accesses that were developed prior to Chapter 34 to be consistent with Chapter 34.
- 4.63 Evaluate and initiate Charter & code amendments related to Public Access, Open Space and Natural Resource Preservation (PONC). These may include:
- a) Clearly distinguish categories of PONC property, such as active or passive use, conservation, restoration, natural buffer areas, access uses, etc. (for

instance, lands acquired to provide access versus lands acquired to preserve from development that may not be appropriate for public access).

- b) Amend Charter Section 10-5 c & f to allow PONC funds to be used for the planning, design, development of new buildings, facilities, (including comfort stations) or infrastructure such as roads, paths, bridges, culverts, ramps, or drainage features if such improvements are necessary to meet the objectives of public safety and to meet the purposes outlined in Hawai'i County Code 2-214.1. [Code]
 - c) Interpret or amend Charter Section 10-15 (c) 3 and County Code Section 2-214.1 c) 3 referring to natural resource buffer zones to include buffer zones for natural hazard areas, such as properties facing sea level rise, lava inundation, steep slopes, or identified priority viewsheds. [Code]
 - d) Include assessments of tax revenue implications for lands nominated for PONC consideration.
 - e) Amend Charter section 10-15 (c) and County Code Section 2-214.1 (c) to be consistent with each other. For example, the County Code allows PONC funds to be used for "significant habitat or ecosystems" but the Charter does not include those terms. [Code]
- 4.64 Amend Chapter 15 to include PONC and trail development as part of the Parks and Recreation Department's priorities to be consistent with Chapter 34 in partnership with the Planning Department.[Code]
- 4.65 Conduct a performance review of the PONC Maintenance Fund and Stewardship Grant program to identify and implement ways to improve PONC management system.
- 4.66 Amend Hawai'i County Code Section 2-218 Prioritized list of qualifying lands worthy of preservation to establish a means to evaluate the socio-environmental equity of the lands nominated by district. Such as:
- a) When there are multiple lands under consideration at any one time, priority shall be given to coastal lands and lands where matching funding is available to leverage the County contribution;
 - b) Consideration should be given to lands within districts under-represented by PONC preservation program. [Code]

AGENCY ACTION

- 4.67 Coordinate with State agencies to improve access and access/trail management resources (including policies, conditions, identification, cataloguing, enforcement, maintenance, etc.).
- 4.68 Consider establishing a working group with surrounding land owners and the user-community to educate users and manage ATV use to ensure that non-pedestrian allowances are not permitted within sections of modern trails that overlap, are congruent, or correspond to ancient or historic trails and its associated features.
- 4.69 Coordinate with hunting associations and other land stewards, to establish clear hunting policies and disseminate education regarding these policies.
- 4.70 To facilitate greater public access to and along the shoreline and elsewhere, amend Hawai'i Revised Statutes 520, Hawai'i's Recreational Use Statute (RUS), to make it less ambiguous and to discourage frivolous lawsuits.

PRESERVING OUR CULTURAL & HISTORIC LEGACIES

Native Hawaiian Values & Practices

SUSTAINABILITY OBJECTIVE

Native Hawaiian language, values and practices are integrated into all County processes.

POLICY

- 419. Ensure Native Hawaiian access rights are clearly expressed in County code, policies, and procedures.
[Rationale: Based on identified gaps in County code and an over-reliance on State statutes to address Native Hawaiian rights. See HRS Section 1-1, 7-1 and Article 12 Section 7 of the Constitution of the State of Hawai'i.]
- 420. Protect all rights, customarily and traditionally exercised for subsistence, cultural, and religious purposes and possessed by ahupua'a tenants who are descendants of Native Hawaiians who inhabited the Hawaiian Islands prior to 1778, subject to the right of the State to regulate such rights. [Public Access, Natural Resources, Health]
[Rationale: Based on identified gaps in County code and an over-reliance on State statutes to address Native Hawaiian rights. See HRS Section 1-1, 7-1 and Article 12 Section 7 of the Constitution of the State of Hawai'i.]

- 421. Prioritize and maintain an education and awareness program for County employees regarding Native Hawaiian culture, values, and resource management.
[Rationale: Based on identified gaps in County capacity to sensitively address Native Hawaiian issues.]
- 422. County shall staff include qualified personnel versed in Hawaiian language, Hawaiian history, and historic preservation to provide dedicated expertise in support of the objectives, policies, and actions stated in this plan.
[Rationale: Based on identified gaps in County capacity to sensitively address native Hawaiian issues.]
- 423. Ensure access for cultural practitioners in areas that may not be appropriate for public access (e.g. Burial sites, specific heiau).
[Rationale: Based on examples of sensitive areas that may need special treatment based on cultural protocol.]
- 424. Support festivals and events that promote Native Hawaiian history and culture.
- 425. Support the development a multi-sector public education program regarding historic sites that target the hospitality industry, real estate agents, site developers, consultants, schools, youth groups, civic organizations, etc.

ACTION

- 4.71 Codify protections of Native Hawaiian customs and gathering rights related to access and cultural preservation.
- 4.72 Identify and inventory important Native Hawaiian cultural and historic places, traditional cultural properties, traditions, and practices, through the use of architectural, archaeological, ethnographic surveys, and oral histories. [Mapping]
- 4.73 Develop an inventory of Native Hawaiian cultural resources and practices with potential to be impacted by sea level rise. Work with Native Hawaiian communities to determine steps they want to take regarding climate impacts. [Climate Change]
- 4.74 Amend the County building code to add standards for structures utilizing traditional Hawaiian building design and construction methods. There may be certain limitations placed on the occupancy or use of these structures, such as for cultural purposes, accessory uses and/or occasional gatherings only. [Code]

PRESERVING OUR CULTURAL & HISTORIC LEGACIES

Multi-Cultural Heritage

SUSTAINABILITY OBJECTIVE

At least one yearly cultural event is supported by the County in each district.

POLICY

- 426. Support festivals and events that promote the island's multi-cultural heritage.
- 427. Represent Hawai'i as a place that embraces not only its own multi-cultural heritage, but all world cultures in inclusive and celebratory ways.
- 428. Promote educational and celebratory opportunities for cultural exchanges with other world cultures.
- 429. Promote opportunities for 'sister city' and other types of place-based cultural enrichment opportunities with international communities.

ACTION

- 4.75 Establish and maintain a County Program (including grants) to support festivals and events that promote history and culture.

PRESERVING OUR CULTURAL & HISTORIC LEGACIES

Historic Preservation

SUSTAINABILITY OBJECTIVE

Achieve 100% preservation of sites identified for preservation by State Historic Preservation Division.

POLICY

- 430. Historic Preservation shall represent the full range and diversity of the multi-cultural heritage of Hawai'i Island.
[Rationale: Based on General Plan Goals 6.2, and Policies 6.3 (a-o).]

431. The County shall maintain an inventory of significant cultural and historic sites and districts compatible with that of the State Historic Preservation Division. The inventory shall identify the location of sites on the Hawai'i and National Register, the State Inventory of Historic Places, and may also include sites of community significance identified as being:

- a) Important in the life or activities of a major historic person;
- b) Associated with a major group or organization in the history of the island or community;
- c) Associated with a major historic event (cultural, economic, military, social, or political);
- d) Associated with a past or continuing institution that has contributed substantially to the life of the community;
- e) Unique example of a particular style or period;
- f) One of the few of its age remaining;
- g) Original materials and/or workmanship that can be valued in themselves;
- h) Sites with a preponderance of original materials in context and complexes rather than single isolated sites unless they are of great significance; and
- i) Sites of traditional and cultural significance.

[Rationale: General Plan 6.3 (a-o).]

432. Preservation plans shall be completed for all subdivisions with cultural or historical properties (sites, buildings, objects, landscapes) identified for preservation prior to approval of the final plat map or any site work.

[Rationale: Based on identified issues where development commences prior to County permit approvals, thereby possibly damaging historic sites or areas. See also General Plan 6.3 (a-o).]

433. The County shall develop a comprehensive management plan for historic and cultural resources that are on County owned properties or on properties managed by the County.

[Rationale: General Plan 6.3 (a-o).]

434. Require completion of preservation plans for all significant sites identified for preservation.

[Rationale: Based on identified issues where development commences prior to County permit approvals, thereby possibly damaging historic sites or areas. See also General Plan 6.3 (a-o).]

435. Require completion of mitigation plans for identified sites, or resources that have been identified as historic but will not be preserved.

[Rationale: Based on identified issues where development commences prior to

completion of mitigation plans, thereby possibly damaging historic sites or areas. See also General Plan 6.3 (a-o).]

436. Require stewardship and/or protection of sites, buildings, objects, and landscapes of significant cultural and historical importance to the County.

[Rationale: Based on General Plan 6.3 (b).]

437. Partner with DLNR-SHPD to outline how each agency will cooperate to ensure historic and cultural protections, verify that approved Preservation Plans are being implemented, and promote appropriate restoration of historic sites and cultural landscapes.

[Rationale: Based on identified needs for further collaboration between State and County agencies and on General Plan 6.3 (a).]

438. Through the Hawai'i County Cultural Resources Commission, the County shall engage in consultation with Section 106, National Historic Preservation Act, and shall use this opportunity to engage the community, especially those with generational and traditional environmental knowledge, in the consultation process.

[Rationale: Based on Section 106 National Historic Preservation Act and the HCC Chapter 2 Article 44.]

439. Subdivisions subject to cultural or historic surveys shall have all sites approved for preservation, including any required buffers or access easements, identified on the plat maps of the subdivision prior to granting of final subdivision approval. The metes and bounds descriptions of the preservation easements and all applicable covenants and restriction pertaining to the preservation easements, shall be added to applicable deeds prior to the transfer of subdivided properties. [code/mapping]

[Rationale: Based on consultation with Administrative Permit Division of Planning Department and identified gaps in comprehensive recordkeeping in subdivision files. See also General Plan 6.3 (g).]

440. Outstanding natural or cultural features, such as scenic resources, water courses, fine groves of trees, heiau, and historical sites and structures, shall be identified and preserved during subdivision.

[Rationale: Based on preserving public trust, and Hawai'i County Code Section 23-26, and General Plan Goals of 6.2, 6.3 (g).] [Mapping]

441. The County shall use and promote the use of interpretive signage and/or other appropriate methods to recognize landscapes, sites, buildings, and objects of significant historical and cultural importance.

- 442. Partner with Community Development Plan Action Committees and the Cultural Resource Commission to develop design guidelines for designated communities containing significant historic buildings, sites, or landscapes.
- 443. Partner with DLNR's State Historic Preservation Division to increase, maintain, and regularly update the State inventory of Historic Places database with significant historical and culturally important sites, buildings, objectives, and landscapes on Hawai'i Island.
- 444. Seek private-public partnerships to maintain and steward the preservation of sites, buildings, objects, and landscapes of significant cultural and historical importance.
- 445. For new County community facilities, incorporate and consider cultural design elements appropriate for the region.
- 446. Establish Historic Districts, Heritage Landscapes, Corridors, Areas, and Centers as land use designations for purposes of preserving, conserving, or restoring historic properties for the benefit of communities' sense of place and appropriate adaptive reuse for future generations.

ACTION

- 4.76 Identify and map valued cultural and historic places, structures, traditions, and practices, and Hawai'i's multi-cultural heritage through the use of architectural, archaeological, ethnographic surveys, and oral histories. [Mapping]
- 4.77 Compile and maintain a list of cultural/historic experts by island districts who may be consulted, as needed.
- 4.78 Complete community-level historic surveys.
- 4.79 Amend the subdivision code, Section 23-69 to include a requirement that the final plat map reflect information from the preservation plan, including any required buffers or access easements. [Code]
- 4.80 Down-zone identified State and County-owned parcels that have special cultural and/or scenic value.
- 4.81 Amend the zoning code to include criteria for requiring cultural preservation plans prior to development. [Code]
- 4.82 Adopt rules that establish when ethnographic Surveys or Cultural Impact Assessments will be required and what standards should be followed.
- 4.83 Develop County-wide Cultural Resource Commission processes for reviewing permit applications that relate to identified cultural or historic resources.

- 4.84 Develop protocols for receiving community input during capital project siting and design. Consult with and solicit input from community members with generational knowledge to minimize the impact of proposed changes to the use of land on cultural practices, cultural sites, and culturally significant areas, including burials.
- 4.85 Adopt design guidelines for designated communities containing significant historic buildings, sites, or landscapes.
- 4.86 Prepare Cultural Landscape Reports, prioritizing Historic Districts to articulate preservation goals, objectives, and policies that provide the basis for making sound decisions about management, treatment, and use of historic and cultural resources. [Report]
- 4.87 Promote the real-property tax incentives for preservation of historic properties.

PROTECTING SCENIC RESOURCES

SUSTAINABILITY OBJECTIVE

Increase participation in scenic preservation programs (Heritage Corridors, Scenic Byways, Scenic Corridors and Exceptional Trees)

POLICY

- 447. Hawai'i County shall use the following place types as guidelines for designating sites and viewsheds that shall be protected:
 - a) Distinctive and identifiable landforms distinguished as landmarks and/or cultural landscapes, e.g. Mauna Kea, Waipi'o Valley.
 - b) Coastline areas of striking contrast, e.g. Laupāhoehoe Point
 - c) Vistas of distinctive features
 - d) Natural or native vegetation attractive to a particular area.
 - e) Landscapes that are harmoniously developed, enhanced by man while maintaining their natural appearance, e.g. Pu'ukoholā, 'Akaka Falls.
 - f) Lands with a general slope of 20 percent or more that provide open space amenities or possess unusual scenic qualities.

[Rationale: Based on the Standards from General Plan 7.4 (a-e) and 8.4 (c).]

- 448. Visual impact assessments shall include photo simulations or balloon tests with views from various vantage points to show visual impact of a proposed project.

[Rationale: Creating visual modeling through photo simulations or balloon tests are

common strategies used in visual impact assessments in other municipalities. These visual impact assessment tools would help achieve General Plan 7.2 Goals and policies 7.3 (b, e, h, i).]

449. Prioritize maintaining the views at scenic overlooks with a frequently maintained vegetation management program which includes eradication of invasive species. Coordinate this work with regular roadway vegetation management maintenance program.

[Rationale: Based on identified challenges with vegetative management of existing scenic overlook and the prevalence of the views being obstructed by invasive species or other vegetation. See also Hāmākua CDP 38, Kōkua Action 9, and General Plan 7.2 (b), 7.3 (a, b, c, f).]

450. Maintain a continuing program to identify and inventory exceptional trees, forest areas, or groves/stands of trees.

[Rationale: Based on Standards from General Plan 7.3 (g) and policies 7.4 (a-e) 8.3 (j, k, m).]

451. Maintain the Exceptional Tree Program for the recognition and protection of trees with significant or unique historical, ecological, cultural and/or aesthetic significance.

[Rationale: Based on General Plan policy 7.3 (g).]

452. No variance shall be granted unless appropriate conditions are imposed to minimize adverse impacts on public views to, from, and along the shoreline.

[Rationale: Based on Hāmākua CDP Policy 17, General Plan goals 7.2 (a-c), and policies 7.3 (b), 8.3 (c, d). See also HRS 205A.

453. Do not allow incompatible development in areas of natural beauty that have been identified through the Scenic Resources Protection Program.

[Rationale: Based on an identified need to identify natural beauty areas through a scenic resource protection program and restrict development appropriately to ensure scenic resources are not lost to development. Based also on General Plan policies 7.3 (h, i).]

[Mapping]

454. Applications for Special Permits and environmental assessment reports for proposed changes of zone on property that may impact open space, viewsheds, and areas of natural beauty shall include visual impact assessments and propose conditions to mitigate scenic impacts.

[Rationale: Based on identified needs to protect scenic resources, open space and natural beauty in the special permit process. Also based on Hāmākua CDP policy 33 and Kaʻū CDP policy 57.]

455. Hawai'i County shall seek to minimize, any development which would substantially interfere with or detract from the line of site toward the sea from the State highway nearest the coast.
[Rationale: Based on Hāmākua CDP Policy 35, Ka'ū CDP Policy 54, General Plan policy 7.2 (b) and 7.3 (f).]
456. Ensure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline.
[Rationale: Based on an identified need to ensure that development is managed appropriately to protect natural landforms and viewplanes. Based also on General Plan policies 7.3 (h, i).] [Land Use]
457. Preserve roadway corridors that have historic, scenic, or unique physical attributes that enhance the character and scenic resources of communities.
458. Support the development and promotion of Heritage Corridors and Scenic Byways where appropriate.
459. Support the designation of scenic byways through the State Scenic Byway Program.
460. In reviewing Special Permit applications, rezoning, and other land use changes in the Agricultural District, appropriate conditions should be determined to preserve existing viewsheds to and along the coastline. [Land Use]

ACTION

- 4.88 Develop and establish viewshed regulations to preserve and protect from obstruction scenic resources, vistas, viewsheds, open space, prominent landscapes, and areas of natural beauty identified in the General Plan.
- 4.89 Develop and maintain a program to identify, inventory, preserve, acquire, and develop (where appropriate) viewing sites on the island. [Transportation]
- 4.90 Collaborate with the State to modify zoning on publicly-owned parcels that have been identified as having special cultural and/or scenic value. [Land Use]
- 4.91 Identify valued scenic resources in the Coastal Zone Management area. [Land Use, Mapping]
- 4.92 Identify and develop scenic lookouts along highways to ensure important views (coastal, mountain, and waterfall) are preserved from development, create various opportunities to view these scenic resources, and develop a vegetation maintenance program.

- 4.93 Establish a Scenic Resources Protection Program to identify, inventory, and protect areas of significant beauty. The program would include:
- a) Rate viewsheds and roadway corridors documented in the Scenic Resources Inventory and Mapping Project (June, 2016)
 - b) Develop scenic resource and viewshed corridor maps
 - c) Develop administrative rules to implement Hawai'i County Code section 25-6-60
 - d) Develop Scenic Corridor Management Plan(s) for specific corridors identified. Scenic Corridor Management Plan(s) should include permit conditions, such as design guidelines, landscaping, screening, or structural setbacks from major thoroughfares and highways, to mitigate any visual impacts from development.
 - e) Prepare Urban Design and Scenic Resource Protection Guidelines
 - f) Staff and Planning Commission Training;
 - g) Set Guidelines for Development Compatibility Standards. [Program]
- 4.94 Develop, maintain, and implement design standards to protect important viewsheds and ensure structural setbacks from major thoroughfares and highways.
- 4.95 Develop Scenic Corridor Management Plans.
- 4.96 Adopt administrative rules to implement Hawai'i County Code for Scenic Corridors.
- 4.97 Perform a feasibility study on developing a scenic route from Waipi'o Valley Lookout extending mauka to connect Mud Lane at the entrance of Waimea and a scenic park with a viewing area of Hi'ilawe Falls.
- 4.98 Coordinate with the State to upgrade the viewing site from the rim of Pololū Valley.

AGENCY ACTION

- 4.99 Encourage the State to develop and maintain scenic lookouts along highways where appropriate to ensure ocean, mountain, pastoral, and waterfall views are preserved from development, and coordinate a regular roadway vegetation maintenance program.
- 4.100 Consider adding/improving viewing locations and interpretive signage near the scenic bridges for safe parking and views of the areas' waterfalls and coastline and along Saddle Road (Route 200) for views of the summit.

PROJECT DOCUMENT

County of Hawai'i General Plan Comprehensive Review

Trend Scenario and Land Use Allocation Technical Report

Date: April 18, 2016

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Introduction

Task S2 (Land Use Allocation) sets up a framework for estimating future development patterns (amounts and location) based on a set of rules. Task E (Trend Scenario) uses an initial, calibrated run of the allocation model to estimate future development patterns based on historical trends. These tasks go hand-in-hand and are combined in this technical report.

Allocation Concepts and Approach

Future development patterns (amounts and location) are estimated using an algorithm-driven process called allocation. Allocation models the interplay between market demand for development in certain locations ("desirability") and amount of development allowed according to current regulations or by future land use patterns suggested by alternate scenarios ("capacity"). Given a pre-determined amount of growth expected in the given time frame (here, new growth between 2015 and 2040), the allocation process estimates where each incremental unit of new development will go, following the basic presumption that the most desirable areas will be developed first, capacity allowing. Thus highly desirable areas are assigned growth first, and then slightly less desirable areas get developed next, etc., until all the estimated growth amount has been accommodated. Numerous refinements to the basic principle are used to produce the final estimates. For example, parcels aren't always filled all the way to capacity, a certain amount of controlled "randomness" is often applied to the growth pattern, etc. For mixed use areas, both residential and non-residential growth can be assigned.

In this study, a CommunityViz tool called *Allocator 5* is used. The methods combined with the algorithms in *Allocator 5* provide a well-reasoned analysis that will be helpful for this and myriad other planning studies, but it is recognized that the results have limitations in terms of modelling precision and confidence. The CommunityViz allocation method is sometimes described as "light-weight" to "medium-weight," differentiating it from the "heavy-weight" algorithms such as UrbanSim or PECAS that are considerably more sophisticated but are more difficult and expensive to implement. In contrast, the *Allocator 5* method is easier to use and lends itself well to "what-if" type scenario planning.

At the highest level, the allocation algorithm takes 3 inputs—growth amount, capacity, and desirability—and generates 1 output—a pattern of future development. Our methods for each of these are described next.

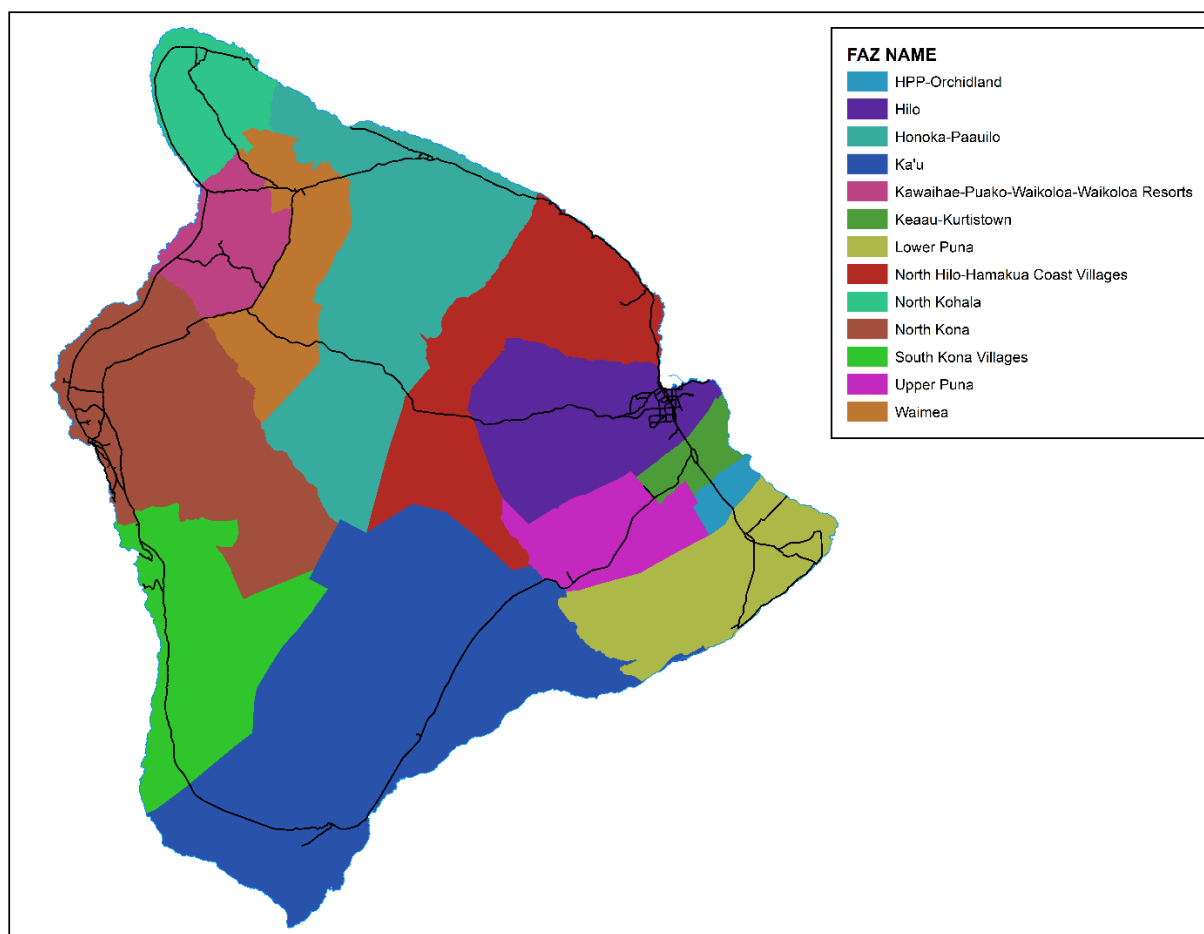
Growth Amount

As a 2015 baseline for housing unit data, Placeways used data from the County's Real Property Tax (RPT) office to identify the number of housing units and non-residential square feet. The procedure began with a database file from RPT that, unfortunately, lacked metadata, so the fields were interpreted manually. For each TMK, buildings were converted to housing units where appropriate

(buildings and dwelling units were tracked separately). Single family homes and 'ohana units were readily identified in the RPT data. Multifamily housing required some additional steps. In cases where there were multiple records per TMK (as with condos), the records required consolidation to identify the total number of dwelling units per TMK. Separate analyses were performed for single family, multifamily, and commercial properties. In RPT data, housing units that are treated as commercial property (e.g., apartments and timeshares) were counted as residential only when the RPT data showed them as such. Once this basic processing was complete, Placeways used the RPT online tool, Google Street View, digital air photos and other tools to verify the number of existing units with the goal of establishing an accurate baseline and using the RPT database to its maximum extent.

For the trend scenario, growth projections are provided by SMS, a Hawai'i-based research and consulting company (see their report "General Plan Comprehensive Review Trends and Forecast Analysis Final Report (2015)"). These projections are broken out by 13 geographic areas called "forecast analysis zones" or FAZs (see Figure 1) and by use type (residential dwelling units and non-residential square feet). In order to add additional land use information to the allocation, the SMS forecasts were further broken down into four categories: single family dwelling units, multifamily dwelling units, commercial square feet, and industrial square feet. The ratio of single family to multifamily was found using the mean of the ratio from three dates in the recent past (2000, 2010, 2015) for which the ratio was known. This ratio was then applied to the combined residential allocation amounts to produce the single family/multifamily splits seen in Tables 1, 3, and 6. Similarly, growth amounts for non-residential development were developed as a single forecast and had to be split into amounts for commercial and industrial uses. The 2013 ACS Employment by Occupation Type data were used to identify the ratio of industrial employment to commercial employment and to produce the splits seen in Tables 2, 3, and 7. While this method assumes no change in the ratio of single family to multifamily units and commercial to industrial space, it reflects the recent development patterns in the Trend Scenario and can easily be adjusted for use in alternate scenarios.

Figure 1. Map of Forecast Analysis Zone (FAZ) Areas (source: SMS)



In contrast to the RPT-based method for establishing a baseline, the housing forecast data produced by SMS rely on US Census and Hawai'i DBEDT as sources. The methods used to collect Census and DBEDT data are quite different from RPT, resulting in differing 2015 baseline quantities. In addition, SMS did not suggest a 2015 baseline, instead using decadal increments for forecasting. In order to establish an SMS 2015 baseline, Placeways used the average of SMS's 2010 and the first forecast year of 2020. This results in a 2015 baseline difference of 11,558 housing units (RPT 2015: 75,100; SMS/Census: 86,658). The reasons that the RPT and Census derived baseline amounts are different are due to the sources' two distinct methods, and no attempt was made to reconcile them.

To calculate the amount of new residential growth, Placeways used a method to find the *relative* amount of net new amount of growth per FAZ. This method finds the percent change, per SMS, between 2015 and 2040 and applies that to the RPT 2015 baseline. This forecast results in fewer net new units (35,750) than the SMS forecast (40,160 new units), but its rates of change match SMS.

The SMS non-residential forecasts were already reconciled with the RPT data, and their forecast was calibrated to closely match the 2015 RPT baseline square footage. Therefore, in the case of non-residential growth, there was no need to rectify the forecast numbers as was the case with residential growth. Non-residential square feet were rounded and translated from square feet to 1,000 square feet

for the purposes of allocation. This ensured that allocation amounts are in whole increments and not in very small portions of square feet.

Table 1. Residential Forecast by FAZ

FAZ	2015			2040 Change		2040 Total		
	Single Family	Multi-family	Total	Single Family	Multi-family	Single Family	Multi-family	Total
Hilo	14,713	1,138	15,851	2,953	833	17,666	1,971	19,636
North Hilo - Hāmākua Coast Villages	2,822	12	2,834	721	71	3,543	83	3,626
Honoka'a-Pa'auilo	2,399	14	2,413	871	56	3,270	70	3,340
Waimea	3,212	98	3,310	1,420	158	4,632	256	4,887
North Kohala	2,499	17	2,516	785	59	3,284	76	3,360
Kawaihae-Puakō-Waikoloa-Waikoloa Resorts	2,610	3,390	6,000	1,337	1,337	3,947	4,727	8,675
North Kona	11,181	5,989	17,170	4,418	2,708	15,599	8,697	24,295
South Kona Villages	3,437	73	3,510	1,129	125	4,566	198	4,765
Ka'ū	3,397	76	3,473	2,135	112	5,532	188	5,720
Kea'au -Kurtistown	1,640	10	1,650	834	35	2,474	45	2,518
Upper Puna	4,884	0	4,884	3,373	104	8,257	104	8,361
HPP-Orchidland	6,654	0	6,654	7,431	152	14,085	152	14,237
Lower Puna	4,835	0	4,835	2,515	78	7,350	78	7,428
Total	64,283	10,817	75,100	29,922	5,828	94,205	16,645	110,850

Table 2. Non-Residential Forecast by FAZ (in 1,000 square feet)

FAZ	2015			2040 Change		2040 Total		
	Commercial	Industrial	Total	Commercial	Industrial	Commercial	Industrial	Total
Hilo	9,187	3,762	12,949	3,979	346	13,166	4,108	17,274
North Hilo - Hāmākua Coast Villages	347	30	377	98	8	445	38	483
Honokaʻa-Paʻauilo	438	38	476	130	7	568	45	613
Waimea	1,303	75	1,379	421	37	1,724	112	1,837
North Kohala	290	255	545	181	12	471	267	738
Kawaihae-Puakō-Waikoloa-Waikoloa Resorts	5,406	63	5,470	1,608	85	7,014	148	7,163
North Kona	6,512	5,135	11,648	3,400	296	9,912	5,431	15,344
South Kona Villages	868	16	884	235	18	1,103	34	1,137
Kaʻū	303	0	303	110	11	413	11	424
Keaʻau-Kurtistown	760	902	1,662	454	51	1,214	953	2,167
Upper Puna	201	2	203	54	3	255	5	260
HPP-Orchidland	120	0	120	57	4	177	4	181
Lower Puna	413	0	413	114	14	527	14	541
Total	26,150	10,279	36,428	10,841	892	36,991	11,171	48,161

Capacity

Capacity values used in this report are based primarily on the results of Task S1, covered in a separate report. The focus is on net capacity, which is gross (or total) capacity minus existing development. Numeric capacity is assigned to every parcel on the island for residential dwelling units, and a separate numeric capacity for non-residential square feet. The majority of visitor units, existing and projected, are within 3 of the 13 FAZ areas. More information on visitor units and how they are addressed can be found in the Indicator Modeling technical report (Task G).

During the initial calibration of the allocation model, it was decided to place caps on the capacity of individual parcels that limited the amount of development that could occur on any single parcel. Caps for both residential and non-residential development were identified by looking at the County's subdivision records and the 2004-2015 building permit data. This information revealed what the recent historical maximums were for each kind of development: 600 units for residential development and 306,000 square feet for non-residential development. (The historical maximums and their place in the model are also discussed below in the section on additional calibration factors.) The final numbers below represent capped net capacity. Later in the project, these capacity values may be adjusted to model different potential planning and policy decisions.

Table 3. Net Capacity (Capped) by FAZ

FAZ Name	Residential Single Family Capacity (DU)	Residential Multifamily Capacity (DU)	Commercial Capacity (sq ft)	Industrial Capacity (sq ft)
Hilo	22,299	1,183	7,037,091	6,766,170
North Hilo - Hāmākua Coast Villages	8,721	50	1,173,273	894,155
Honoka'a-Pa'auilo	9,691	39	579,692	133,073
Waimea	6,807	827	1,242,247	577,334
North Kohala	9,950	231	1,660,320	1,499,805
Kawaihae-Puakō-Waikoloa-Waikoloa Resorts	15,237	3,815	1,944,304	310,342
North Kona	21,855	5,376	9,831,956	12,956,188
South Kona Villages	21,445	190	539,714	0
Ka'ū	25,088	1,971	768,304	620,075
Kea'au-Kurtistown	5,518	75	1,481,939	4,484,680
Upper Puna	25,390	31	135,975	0
HPP-Orchidland	9,996	0	0	0
Lower Puna	25,928	151	656,727	74,451
Total	207,925	13,939	27,051,542	28,316,273

Desirability

Desirability is a complex topic and represented a large proportion of the effort for this task.

The desirability of a given parcel for a given use (residential or commercial) is represented by a score from 0 (least desirable) to 100 (most desirable). A parcel that is not eligible for a given use is assigned a desirability score of -1. On a map, the pattern of desirability scores is sometimes called a “desirability surface” because one can picture a lumpy blanket covering the island with high points in areas of high desirability and low points in areas of low desirability.

Desirability was calculated all at once for the entire island. Given more time and resources, it would be possible to perform separate calculations for subareas such as east/west or individual FAZs. However, the additional effort would make little difference because growth amounts are constrained to meet FAZ-specific totals and thus growth is allocated based on relative desirability scores within a FAZ, not between FAZs.

The detailed procedure for creating the initial desirability surface, used to create the Trend Scenario, follows:

1. Spatial and non-spatial factors affecting location desirability were hypothesized. These factors, such as proximity to infrastructure or coastline, likely affected development desirability in the past and could be quantified for all parcels on the island given available information. While a complete list of factors tested is included at the end of this report, all hypothesized factors could fit into the following categories:
 - Distance to infrastructure, geographical features, town and commercial centers
 - Parcel shape/size
 - Terrain/climate characteristics
 - Neighbor (10 ft) and neighborhood (1000 ft) context: the number of nearby parcels and development proximity (the number of nearby parcels that are built)
 - Current land use and build status
 - Geographic location (District, FAZ, etc.)
 - Property and building valuation.

Using CommunityViz, these factors were calculated for each parcel on the island and exported to a table for use in SPSS statistical analysis software.

2. Statistical regression analysis in SPSS was used to calculate how well each factor correlates with new development in a given time frame. Three timeframes were initially considered:
 - All development since the beginning of RPT (County of Hawai'i Real Property Tax Office) recordkeeping (1880s)
 - All development since 1995
 - All development between 1975 and 1995.

However, because the goal of this statistical regression was to capture the principal factors influencing urban growth in the *recent* past, a cutoff date of 1995 was established. This year was selected to encompass a full cycle of real estate development and to capture the "highs and lows" in development activity. Development during this period followed this approximate pattern:

- Trough: 1996
- Peak: 2005-2006
- Trough: 2009-2011
- Recent uptick: 2015.

The SMS CoH 2016 General Plan Final Report (Figure 1, Resident Population) illustrates this pattern.

The statistical analysis models the relationship between dependent variables – Commercial Square Feet (COM_SQFT) and Number of Residential Buildings (NumberOfResidences) – and the hypothesized list of independent variables (see Appendix 1, Table 12. Factors Tested for Historical Growth Trends). As a result, a step-wise Multiple Linear Regression model was chosen to create coefficients associated with each of the variables in order to represent the independent contributions of each independent variable to the prediction of the dependent variable after controlling for all other independent variables.

The initial analysis included an overall view of development, an earlier era of development (1975-95), and post-1995 recent development patterns for both of the dependent variables (see Appendix 1: *Comparing Post 1995 Regression Factors with the 1975-1995 Regression Factors* for a discussion of these results). The results show the top 10 variables—that is, the top 10 of the hypothesized desirability factors—that influence each of the analyses, along with the absolute value of each of the standardized coefficients. The coefficient values allow ranking the variables from most to least influential. Detailed analysis information is included at the end of this report.

The standardized regression coefficients with the 10 highest absolute beta values for the post-1995 period were converted into CommunityViz weighting factors normalized to the scale 0 – 10, where 0 is no correlation and 10 is the highest correlation of any factor (though less than 1). Candidate factors with lower beta coefficients, below the top ten, were ignored for the desirability score.

A cutoff of 10 factors was chosen for a few reasons. One was to keep the most significant factors in the mix. The top 10 account for the majority of the causal influence of all factors tested. Additionally, there was a benefit to limiting the number of movable parts for testing. Even with 10, it is challenging to understand the interplay of all inputs and the individual effect on the overall score. The goal here is to incorporate both sophistication and manageable interactive parts, and 10 is a reasonable number for that.

Some factors are negatively correlated, and some factors are inversely correlated. For instance, distance values that correlate to growth are often inverse: nearer, smaller distance values are more desirable and further, larger distance values are less desirable. In the table below, negative and inverse correlations are indicated by a negative beta value score. Understanding this, many factors below make intuitive sense. The slope factor for example suggests that as land gets steeper (slope increases), the likelihood of development decreases. Some results are not always intuitive, however. Statistically, for example, it is found that parcels that are *closer* to old lava flows are more desirable for non-residential development than those far away (i.e. Distance2LavaFlow1790). Some positively correlated cases also benefit from some explanation. For example, the strongest factor for residential development is Distance2VolcanoHazard. This is a positively correlated factor meaning that as distance increases away from volcano hazards, the likelihood of development also increases.

Table 4. Residential Factors (Top 10) for Growth Desirability Model (Post 1995 Development)

Factor	Description	Beta Value	Absolute Beta Value	Normalized Value (Weighting)
Distance2VolcanoHazard	Distance to high volcano risk area, defined as areas classified as category 1 or 2 on the risk layer	0.0808	0.0808	10
Distance2LavaFlow1250	Distance to older lava flow, deposited between the year 1250 and the present	-0.0575	0.0575	7.1
Slope	Mean slope of the parcel in percent rise	-0.0494	0.0494	6.1
Intersections1miDensity	Road intersection density: the number of intersections on major roads within ½ mi of the parcel divided by area of the parcel	-0.0439	0.0439	5.4
Rainfall	Annual average rainfall, in inches	-0.0429	0.0429	5.3
Distance2CenterAdjusted	Network distance to commercial center. Commercial center is defined by RPT land use "commercial." This adjusted value uses straight line distance for those features not picked up by the patchy network.	-0.0411	0.0411	5.1
RESpot1995ProximitySum1000ft	Total number of dwelling units on parcels within 1000 ft of a parcel built after 1995	-0.0394	0.0394	4.9
RESpot1995ProximitySum10ft	Total number of dwelling units on parcels within 10 ft of a parcel built after 1995	-0.0321	0.0321	4
ParcelPerimeter2DivArea	Lot shape: perimeter squared divided by area	0.0305	0.0305	3.8
Distance2Coastline	Distance to the island's coastline	-0.0301	-0.0301	3.73

Table 5. Non-Residential Factors (Top 10) for Growth Desirability Model (Post 1995 Development)

Factor	Description	Beta Value	Absolute Beta Value	Normalized Value
Distance2LavaFlow1790	Distance to recent lava flow, deposited since 1790	-0.3410	0.3410	10
Intersections1miDensity	Road intersection density: the number of intersections on major roads within ½ mi of the parcel divided by area of the parcel	-0.2560	0.2560	7.5
Distance2Airports	Distance to nearest major airport	0.2246	0.2246	6.6
Proximity1000ftParcelDensity	The number of parcels within 1000ft divided by the area of the parcel	0.1723	0.1723	5
Distance2ExistingMF1	Distance to nearest multifamily residential development	-0.1380	0.1380	4
Distance2SewerService	Distance to nearest wastewater service line	-0.1207	0.1207	3.6
Distance2WaterService	Distance to nearest potable water service line	0.1089	0.1089	3.2
Proximity10ftParcelDensity	The number of parcels within 10 ft divided by the area of the parcel	-0.1006	0.1006	3
ParcelPerimeter2DivArea	Lot shape: perimeter squared divided by area	-0.0935	0.0935	2.7
Distance2VolcanoHazard	Distance to high volcano risk area, defined as areas classified as category 1 or 2 on the risk layer	0.0885	0.0885	2.6

3. The CommunityViz Suitability Wizard was then used to create a suitability analysis using the parcels' normalized factor values (such as distance to roads) as inputs. Since these values were pre-calculated for the statistical analysis, Suitability Wizard was pointed directly at the numeric values, improving processing performance. The wizard default is set to 5 (on a scale of 0 to 10) for each factor weighting. After the suitability analysis is run with defaults, the weighting assumption defaults are set for each factor according to the values calculated in the previous step to calibrate the score to historical trends.
4. The suitability (desirability) score for each parcel is displayed using the parcels layer symbolized by the suitability scores. The factor weightings are adjustable, so each factor that contributes to the overall score can be given a level of priority appropriate to the goals of the scenario.

Trend Scenario Allocation

The allocation of forecasted development in the “Trend Scenario” is based on the desirability surface representing historic development trends. Later in the project, it will be possible to develop alternate desirability surfaces for scenario planning in which planners test planning strategies that could encourage growth to evolve in particular ways.

Allocation is performed using Allocator 5 with the inputs above. Again, allocation distributes predetermined growth amounts for each FAZ to parcels within that FAZ, developing the most desirable parcels first and proceeding until all growth has been accommodated. No parcel receives more development than it has capacity for, and many parcels receive little or no development even though they have capacity available. For the initial run, used to develop the Trend Scenario, randomness is set at 1 out of 10. Results for each FAZ are as follows:

Table 6. Allocated Residential Growth by FAZ

FAZ Name	Residential Single Family Dwelling Units	Remaining Single Family Capacity	Residential Multifamily Dwelling Units	Remaining Multifamily Capacity
Hilo	2,952	19,347	833	350
North Hilo - Hāmākua Coast Villages	721	8,000	50	0
Honoka‘a-Pa‘auilo	871	8,820	39	0
Waimea	1,419	5,388	158	669
North Kohala	785	9,165	59	172
Kawaihae-Puakō-Waikoloa-Waikoloa Resorts	1,338	13,899	1,338	2,477
North Kona	4,418	17,437	2,708	2,668
South Kona Villages	1,130	20,315	126	64
Ka‘ū	2,135	22,953	112	1,859
Kea‘au-Kurtistown	833	4,685	35	40
Upper Puna	3,373	22,017	31	0
HPP-Orchidland	7,431	2,565	0	0
Lower Puna	2,515	23,413	78	73
Total	29,921	178,004	5,567	8,372

Table 7. Allocated Non-Residential Growth by FAZ in 1,000 square feet

FAZ Name	Commercial Allocated	Remaining Commercial Capacity	Industrial Allocated	Remaining Industrial Capacity
Hilo	3,979	3,039	346	6,424
North Hilo - Hāmākua Coast Villages	98	1,074	8	887
Honokaʻa-Paʻauilo	130	450	7	125
Waimea	421	814	37	541
North Kohala	181	1,479	12	1,487
Kawaihae-Puakō-Waikoloa-Waikoloa Resorts	1,608	336	85	224
North Kona	3,400	6,411	296	12,656
South Kona Villages	235	303	0	0
Kaʻū	110	655	11	609
Keaʻau-Kurtistown	454	1,023	51	4,434
Upper Puna	54	80	0	0
HPP-Orchidland	0	0	0	0
Lower Puna	114	542	14	60
Total	10,784	16,206	867	27,447

Trend Calibration Factors

In order to better replicate the patterns of the previous 20 years, additional calibration factors were developed to supplement the factors used in the statistical analysis. The objective of the Trend Scenario is to reflect a continuation of recent patterns, and these factors help reflect the recent development characteristics. While the statistical analysis provides an impartial and “data-driven” perspective on the patterns of recent development, its results cannot provide a complete picture because of a number of limitations:

- Data limitations. Data were not available on all factors and across all historic time scales. In particular, the model lacked in-depth real estate market data, including market conditions and consumer preferences for both residential and non-residential development. In addition, historic building data were not available in appropriate forms.
- Geographic biases that resulted from using parcel data as the unit of analysis. For example, large parcels tended to score very well in the statistical analysis. These features tend to show advantages that small parcels do not: they have more capacity, they have more neighboring parcels, and they can be closer to more desirable locations simply because of their size. A grid-based analysis would reduce these issues, but it would introduce many other issues (e.g., mismatch between the grids and the available parcel data) in their place.
- Difficulty reflecting all patterns and preferences for all the island at a local scale (e.g., what drives growth in North Kona is somewhat different from what drives growth in Lower Puna). It was outside the scope of this project to run individual analyses for smaller areas (e.g., FAZs).

- No forecast model is perfect, and it is expected that any algorithmic results will require some degree of adjustment to match observed results.

Because of these limitations on factors derived solely from statistical analysis, additional calibration factors based on expert human knowledge were included in the analysis as well. The combination resulted in a hybrid system that carefully combines both statistical modeling and expert judgement. Each calibration factor works in a different way to help fine-tune the model by what is believed as common knowledge by County of Hawai'i planners and by comparing values observed in the recent development data to the results of the draft versions of the Trend Scenario allocation.

Some of these factors (Redevelopment Friction, Residential Subdivision Friction and Non-residential Size Friction) help steer growth towards areas that have received consistent development pressure in the previous 20 years. The Pipeline Projects Factor prioritizes parcels that currently have development proposals pending. While these factors help calibrate the Trend Scenario to reflect recent patterns, it is difficult—and not necessarily desirable—to exactly replicate rates and patterns of the recent past with what occurs in the Trend Scenario's modeled future. The future is unknown and many external factors and unforeseeable conditions will affect how growth actually occurs. The goal of the Trend Scenario is to provide a plausible and useful reference for comparing alternative scenarios to help inform policy and the contents of the General Plan; it is not intended as a detailed forecast.

Recent Lava Factor

While a significant amount of development in the County of Hawai'i occurs on geologically recent lava flow (often on lava less than a few hundred years old), lava that has been deposited very recently is a significant obstacle to development. Lava flows that are more recent than 1990 were identified, and desirability of parcels that overlapped post-1990 lava flows was reduced.

Pipeline Projects Factor

This factor adds a bonus to the desirability of parcels that are currently under development or that County planning staff assume are likely to develop in the near future. The pipeline projects are divided into two groups. Group one consists of two projects, Kamakana Villages and Kealakehe Homesteads, which are very likely to develop or are in the process of development. The second group includes five projects that are less advanced in the planning process but have greater than average chances of developing. The project pipeline projects are mostly located in North Kona and primarily entail residential development. Table 8 identifies the pipeline projects and the number of units allocated to them.

Table 8. Pipeline projects

Project Name	Approximate Location	Allocated Residential Units
Kamakana Villages	Ane Keohokālole Highway, North of Kailua Kona	600
Kealakehe Homesteads	North of Kailua-Kona, Corner of Keanalehu & Manawalea	184
UH Pālamānu	UH West Hawai'i campus, just east of airport	300
Pualani	South of Kailua-Kona along Queen Ka'ahumanu highway	178
Keahuolū Queen Lili'uokalani Trust	Various parcels, north of Kailua-Kona downtown	48

Redevelopment Friction

The uncalibrated allocation model orients development towards areas of greater desirability and available capacity. Many parcels already have existing residential or non-residential structures on them but according to the capacity analysis have some additional capacity (these parcels are considered “underbuilt” for purposes of the model). The Redevelopment Friction factor considers redevelopment in the sense of any new development on a parcel that has an existing residential or non-residential structure (according to RPT). The uncalibrated model does not distinguish the nature of this new development: whether it is a physical addition to a structure, a new structure on an undeveloped portion of the parcel, or the wholesale redevelopment of an existing structure. Redevelopment areas can sometimes be more difficult and costly to develop but they may be highly desirable because of their location or other amenities. The 2004-2015 building permit data reveal that 34% of residential development occurred on parcels that already had a residential or non-residential structure. This figure is lower for commercial development, where 15% of growth occurred on parcels with existing structures. The Redevelopment Friction factor applies a penalty to the desirability score for both residential and non-residential development to parcels that already have some development.

Residential Subdivision Friction

An analysis of residential growth since 1995 revealed that over 75% of new dwelling units were built on parcels that were subdivided to sizes of less than 5 acres. Subdivisions yielding parcels larger than 25 acres were not as common and did not contain large amounts of residential development in the recent past. The County's subdivision data revealed that in the last fifteen years, the largest subdivision to be approved was 590 parcels. During initial runs of the allocation model, it was observed that the tool tended to select larger parcels over smaller parcels, a pattern that was not consistent with the recent development patterns. The County's subdivisions layer depicts all of the island's major subdivisions and using this data as a guide, subdivided parcels were flagged and received higher desirability scores than

non-subdivided parcels. This factor actually consists of two factors, one factor that penalizes large parcels by size and another that caps residential development at 600 units, similar to the historic maximum.

Non-residential Footprint Friction

Similar to residential subdivision friction, recent non-residential development had certain characteristics related to building footprint size (i.e., the square footage of the non-residential development) that were not well captured by the regression analysis. Early runs of the model revealed some extremely large non-residential developments that seemed uncharacteristic with the recent development patterns. According to RPT records, the largest commercial development since 1995 was 306,000 square feet and the median size 6,510 square feet. For the Trend Scenario, non-residential capacity was capped at 300,000 and desirability was boosted for smaller capacity parcels.

Comparing Recent Development Trends and the Trend Scenario

After calibration, the Trend Scenario matches recent development patterns fairly well, as shown in the table below.

Table 9. Comparing recent development with the trend scenario

	Recent Development* 2004-2015	Trend Scenario
Residential Redevelopment	11% of recent growth occurred on built parcels	4% of growth occurs on built parcels
Commercial Redevelopment	15% of recent growth occurred on built parcels	16% of growth occurs on built parcels
Residential Subdivision Development	75% of recent growth occurred in existing subdivisions; median parcel size is 0.7 acres	73% of recent growth occurs in existing subdivisions; median parcel size is 0.9 acres
Non-residential Footprint Friction	Median development size was 6,510 square feet	Median development size is 5,000 square feet

* Recent redevelopment is based on RPT and building permit data; subdivision and parcel size factors use RPT data.

Appendix 1. Comparing Post 1995 Regression Factors with the 1975-1995 Regression Factors

The regression analysis conducted for all development and development post-1995 was also run for development that occurred between 1975 and 1995. Development in this era appeared to manifest some similar patterns (Distance to Volcano Hazards, Lava Flow, and Intersection Density) as the post 1995 development. Distance to centralized services such as water and sewer systems was more strongly correlated in the 1975-95 development, perhaps reflecting the closer proximity of development in that era to those services. In a more extreme case, the correlation for Distance2Airport reverses: it is negative for 1975-95 development and positive for post 1995 development. In other words, as distance to airports diminishes the likelihood of development increases in the 1975-95 era. The opposite is true for development in the post 1995 era.

Valuation factors (building, land values) were poorly correlated in the 1975-95 era for residential development. Valuation factors were more strongly correlated with non-residential square footage. However, the valuation factors used reflect present-day conditions. In general, care should be taken when comparing the results of the 1975-95 era beta values with the post 1995 beta values because this analysis relies on data that represents conditions as they are now, not as conditions were during the 1975-95 phase of the island's development. Some factors rely on data that has remained relatively consistent through time; for example the location of the island's coastline, slope, rainfall patterns, etc. are very similar now to how they were 40 years ago. Other factors have changed considerably since the 1975-95 development occurred (distance to commercial development, development proximity, land and building valuations, etc.). The 1975-95 development patterns would be better compared to the post 1995 development by factoring in the conditions as they existed in that 1975-95 era, not conditions as they exist in the present day. Unfortunately that level of analysis was not feasible within the scope of the current project. Below are two tables comparing the 1975-95 and the post 1995 beta values for residential and nonresidential development.

Table 10. Comparing post 1995 and 1975-95 non-residential beta values

Factor	ComPost95Beta	Com75-95Beta	Difference
Distance2LavaFlow1790	-.341	.006	-0.3474
Intersections1miDensity	-.256	-.100	-0.1564
Distance2Airports	.225	-.145	0.3700
Proximity1000ftParcelDensity	.172	-.042	0.2140
Distance2ExistingMF1	-.138	-.126	-0.0120
Distance2SewerService	-.121	.161	-0.2813
Distance2WaterService	.109	.013	0.0958
Proximity10ftParcelDensity	-.101	.019	-0.1196
ParcelPerimeter2DivArea	-.093	.077	-0.1703
Distance2VolcanoHazard	.088	.090	-0.0016

Table 11. Comparing post 1995 and 1975-95 residential beta values

Factor	ResPost95Beta	ResPost75-95Beta	Difference
Distance2VolcanoHazard	.081	.079	0.0017
Distance2LavaFlow1250	-.057	-.173	0.1151
Slope	-.049	-.049	0.0000
ValueBuilding	.049	.010	0.0389
Intersections1miDensity	-.044	-.078	0.0338
Rainfall	-.043	-.007	-0.0359
Distance24CenterAdjusted	-.041	-.028	-0.0132
RESpost1995ProximitySum1000ft*	-.039	#N/A	-0.0419
RESpost1995ProximitySum10ft**	-.032	#N/A	-0.0273
ParcelPerimeter2DivArea	.031	.037	-0.0067

* The 1975-95 results used the factor, RESpost7595ProximitySum1000ft instead of the post 1995 proximity sums, yielding the beta value of 0.002.

** The 1975-95 results used the factor, RESpost7595ProximitySum10ft instead of the post 1995 proximity sums, yielding the beta value of -0.005.

Table 12. Factors Tested for Historical Growth Trends

Factor Name	Description	Unit	Source
Acres	Size of the parcel in acres	acres	
Distance2Airports	Distance to nearest major airport	feet	County GIS
Distance2Belt10	Distance to the island's belt road	feet	County GIS
Distance2Coastline	Distance to coastline	feet	County GIS
Distance24CenterAdj	Network distance to commercial center. Commercial center is defined by RPT land use "commercial," this adjusted value used straight line distance for those features not picked up by the patchy network.	feet	RPT and county GIS
Distance2ElectricService	Distance to nearest electric utility pole	feet	County GIS
Distance2ExistingMF1	Distance to nearest multifamily residential development	feet	RPT and county GIS
Distance2ExistingSF1	Distance to nearest single family residential development	feet	RPT and county GIS
Distance2Hospitals	Distance to hospitals	feet	County GIS
Distance2LavaFlow1250	Distance to older lava flow, deposited since 1250	feet	USGS Hawai'i Geologic Map
Distance2LavaFlow1790	Distance to recent lava flow, deposited since 1790	feet	USGS Hawai'i Geologic Map
Distance2Major10	Distance to nearest major, arterial-type road	feet	County GIS

Factor Name	Description	Unit	Source
Distance2Schools	Distance to nearest public school	feet	County GIS
Distance2SewerService	Distance to nearest wastewater service line	feet	County GIS
Distance2Towns	Distance to nearest major town, towns defined by county provided "towns" layer	feet	County GIS
Distance2VolcanoHazard	Distance to high volcano risk area, defined as areas classified as category 1 or 2 on the risk layer	feet	USGS, via county GIS
Distance2WaterService	Distance to nearest potable water service line	feet	County GIS
Slope	Mean slope of the parcel in percent rise	percent rise	USGS DEM
ValueLand	Land value in dollars per the County's RPT records	dollars	RPT
Rainfall	Annual average rainfall, in inches	inches	University of Hawai'i
District	Planning district		County GIS
FAZ	Forecast analysis zone		SMS
MaukaMakaiNum	Uses 1 or makai (outside the belt) and 2 for mauka (inside the belt)		Placeways
COM_YRBLT_YN	If built 1, if not 0.		RPT
RES_YRBLT_YN	If built 1, if not 0.		RPT
isCom	If commercial, 1; if not, 0		RPT
isSF	If single family residential, 1; if not, 0		RPT
isMF	If multifamily residential, 1; if not, 0		RPT
COMAllYearsProximitySum10ft	Total commercial square feet on parcels within 10ft of any parcel with commercial square footage		RPT
COMAllYearsProximitySum1000ft	Total commercial square feet on parcels within 1000ft of any parcel with commercial square footage		RPT
COMpost1995PS1000ft	Total commercial square feet on parcels within 1000ft of any parcel with a structure built after 1995		RPT
COMpost1995PS10ft	Total commercial square feet on parcels within 10ft of any parcel with a structure built after 1995		RPT
RESAllYearsProximitySum10ft	Total number of dwelling units on parcels within 10ft of any parcel with a residential structure		RPT
RESAllYearsProximitySum1000ft	Total number of dwelling units on parcels within 1000ft of any parcel with residential structure		RPT
DUPost1995PS10ft	Total number of dwelling units on parcels within 10 ft of any parcel with a structure built after 1995		RPT
DUPost1995PS1000ft	Total number of dwelling units on		RPT

Factor Name	Description	Unit	Source
	parcels within 1000 ft of any parcel with a structure built after 1995		
ParcelPerimeter2DivArea	Lot shape: perimeter squared divided by area	square feet/feet	County GIS
Intersections1/2miDensity	Road intersection density: the number of intersections on major roads within ½ mi of the parcel divided by area of the parcel	intersection per acre	County GIS
Proximity10ftParcelDensity	The number of parcels within 10ft divided by the area of the parcel	Parcels per acre	County GIS
Proximity1000ftParcelDensity	The number of parcels within 1000ft divided by the area of the parcel	Parcels per acre	County GIS

Appendix 2. Detailed Statistical Methods

Commercial All Data

The first multiple linear regression was calculated to predict *COM_SQFT* for all possible parcels based on *ParcelPerimeter2DivArea*, *Intersections1miDensity*, *Slope*, *Rainfall*, *Distance2Major10*, *Distance2WaterService*, *Distance2SewerService*, *Distance2Schools*, *Distance2Coastline*, *Distance2VolcanoHazard*, *Distance2Airports*, *Distance2LavaFlow1250*, *Distance2LavaFlow1790*, *Distance2Towns*, *Distance2ElectricService*, *Distance2Hospitals*, *Distance24CenterAdjusted*, *Distance2ExistingSF1*, *Distance2ExistingMF1*, *Distance2Belt10*, *COMAllYearsProximitySum10ft*, *COMAllYearsProximitySum1000ft*, *ValueLand*, *Proximity10ftParcelDensity*, *Proximity1000ftParcelDensity* with $n = 132,842$. A significant regression equation was found ($F(28,132814) = 161.888$, $p < 0.001$) with an R^2 of 0.033.

After the analysis the 12 coefficients that influence Commercial square feet are listed below.

Table 13. Twelve most influential variables for commercial square feet, all years

Variables	Beta Value Coefficient
COMAllYearsProximitySum10ft	.125
COMAllYearsProximitySum1000ft	.056
Distance2VolcanoHazard	.054
Intersections1miDensity	-.051
Distance2Hospitals	.037
Distance2LavaFlow1790	.032
Distance2ExistingSF1	.025
Distance2ElectricService	-.023
Distance2ExistingMF1	-.020
Slope	-.019
Distance2SewerService	-.018
Distance2LavaFlow1250	-.018

Commercial Post 1995

The first multiple linear regression was calculated to predict *COM_SQFT* commercial buildings built on or after 1995 based on *ParcelPerimeter2DivArea*, *Intersections1miDensity*, *Slope*, *Rainfall*, *Distance2Major10*, *Distance2WaterService*, *Distance2SewerService*, *Distance2Schools*, *Distance2Coastline*, *Distance2VolcanoHazard*, *Distance2Airports*, *Distance2LavaFlow1250*, *Distance2LavaFlow1790*, *Distance2Towns*, *Distance2ElectricService*, *Distance2Hospitals*, *Distance24CenterAdjusted*, *Distance2ExistingSF1*, *Distance2ExistingMF1*, *Distance2Belt10*, *COMpost1995ProximitySum1000ft*, *COMpost1995ProximitySum10ft*, *ValueLand*, *Proximity10ftParcelDensity*, *Proximity1000ftParcelDensity* with $n = 451$. A significant regression equation was found ($F(27,424) = 2.259$, $p < 0.001$) with an R^2 of 0.126.

After the analysis the 12 coefficients that influence Commercial square feet after 1995 are listed below.

Table 14. Twelve most influential variables for commercial square feet, post 1995

Variables	Absolute Value Coefficient
Distance2LavaFlow1790	-.341
Intersections1miDensity	-.256
Distance2Airports	.225
Proximity1000ftParcelDensity	.172
Distance2ExistingMF1	-.138
Distance2SewerService	-.121
Distance2WaterService	.109
Proximity10ftParcelDensity	-.101
ParcelPerimeter2DivArea	-.093
Distance2VolcanoHazard	.088
ValueLand	.082
Distance2Towns	-.067

Commercial Post 1975-95

The first multiple linear regression was calculated to predict *COM_SQFT* commercial buildings built on or after 1975 and before 1995 based on *ParcelPerimeter2DivArea*, *Intersections1miDensity*, *Slope*, *Rainfall*, *Distance2Major10*, *Distance2WaterService*, *Distance2SewerService*, *Distance2Schools*, *Distance2Coastline*, *Distance2VolcanoHazard*, *Distance2Airports*, *Distance2LavaFlow1250*, *Distance2LavaFlow1790*, *Distance2Towns*, *Distance2ElectricService*, *Distance2Hospitals*, *Distance24CenterAdjusted*, *Distance2ExistingSF1*, *Distance2ExistingMF1*, *Distance2Belt10*, *COMpost1995ProximitySum1000ft*, *COMpost1995ProximitySum10ft*, *ValueLand*, *Proximity10ftParcelDensity*, *Proximity1000ftParcelDensity* with $n = 687$. A significant regression equation was found ($F(27,660) = 3.634$, $p < 0.001$) with an R^2 of 0.129.

After the analysis the 12 coefficients that influence Commercial square feet between 1975-95 are listed below.

Table 15. Twelve most influential variables for Commercial Square Feet > 1975 and < 1995

Variables	Beta Value Coefficient
Distance2SewerService	.161
Distance2Airports	-.145
ValueLand	-.144
Distance2ExistingMF1	-.126
Distance2ExistingSF1	-.126
Distance2Schools	.109
Intersections1miDensity	-.100
Distance2VolcanoHazard	.090
ParcelPerimeter2DivArea	.077
Distance24CenterAdjusted	-.072
Distance2Coastline	-.070
Distance2Belt10	-.059

Residential All Data

The first multiple linear regression was calculated to predict NumberOfResidences for residential buildings built after 1995 based on *ParcelPerimeter2DivArea*, *Intersections1miDensity*, *Slope*, *Rainfall*, *Distance2Major10*, *Distance2WaterService*, *Distance2SewerService*, *Distance2Schools*, *Distance2Coastline*, *Distance2VolcanoHazard*, *Distance2Airports*, *Distance2LavaFlow1250*, *Distance2LavaFlow1790*, *Distance2Towns*, *Distance2ElectricService*, *Distance2Hospitals*, *Distance24CenterAdjusted*, *Distance2ExistingSF1*, *Distance2ExistingMF1*, *Distance2Belt10*, *RESAllYearsProximitySum10ft*, *RESAllYearsProximitySum1000ft*, *ValueLand*, *Proximity10ftParcelDensity*, *Proximity1000ftParcelDensity* with $n=132,842$. A significant regression equation was found ($F(27,132,815) = 73.875$, $p < 0.001$) with an R^2 of 0.015.

After the analysis the 12 coefficients that influence Number of Residences the most are listed in the following table.

Table 16. Twelve most influential variables for residential, all years

Variables	Beta Value Coefficient
Distance2LavaFlow1250	-.062
Distance2VolcanoHazard	.060
Distance2ExistingMF1	-.050
Distance2SewerService	-.048
Intersections1miDensity	-.043
Distance2WaterService	.035
Distance2Coastline	-.028
Distance2Airports	.028
Rainfall	-.025
Distance2Towns	-.024
RESAllYearsProximitySum1000ft	.022
Slope	-.021

Residential Post 1995

The first multiple linear regression was calculated to predict NumberOfResidences for residential buildings built on or after 1995 based on *ParcelPerimeter2DivArea*, *Intersections1miDensity*, *Slope*, *Rainfall*, *Distance2Major10*, *Distance2WaterService*, *Distance2SewerService*, *Distance2Schools*, *Distance2Coastline*, *Distance2VolcanoHazard*, *Distance2Airports*, *Distance2LavaFlow1250*, *Distance2LavaFlow1790*, *Distance2Towns*, *Distance2ElectricService*, *Distance2Hospitals*, *Distance24CenterAdjusted*, *Distance2ExistingSF1*, *Distance2ExistingMF1*, *Distance2Belt10*, *DUpost1995ProximitySum10ft*, *DUpost1995ProximitySum1000ft*, *ValueLand*, *Proximity10ftParcelDensity*, *Proximity1000ftParcelDensity* with $n=18,819$. A significant regression equation was found ($F(27,18,792) = 11.549$, $p < 0.001$) with an R^2 of 0.016.

After the analysis the 12 coefficients that influence Number of Residences built after 1995 the most are found in the table below.

Table 17. Twelve most influential variables for residential, post 1995

Variables	Beta Value Coefficient
Distance2VolcanoHazard	.081
Distance2LavaFlow1250	-.057
Slope	-.049
Intersections1miDensity	-.044
Rainfall	-.043
Distance24CenterAdjusted	-.041
RESpot1995ProximitySum1000ft	-.039
RESpot1995ProximitySum10ft	-.032
ParcelPerimeter2DivArea	.031
Distance2Coastline	-.030
Distance2Schools	-.029
Distance2Hospitals	0.23

Residential 1975-95

The first multiple linear regression was calculated to predict NumberOfResidences for residential buildings built on or after 1975 and before 1995 based on *ParcelPerimeter2DivArea*, *Intersections1miDensity*, *Slope*, *Rainfall*, *Distance2Major10*, *Distance2WaterService*, *Distance2SewerService*, *Distance2Schools*, *Distance2Coastline*, *Distance2VolcanoHazard*, *Distance2Airports*, *Distance2LavaFlow1250*, *Distance2LavaFlow1790*, *Distance2Towns*, *Distance2ElectricService*, *Distance2Hospitals*, *Distance24CenterAdjusted*, *Distance2ExistingSF1*, *Distance2ExistingMF1*, *Distance2Belt10*, *DUpot1995ProximitySum10ft*, *DUpot1995ProximitySum1000ft*, *ValueLand*, *Proximity10ftParcelDensity*, *Proximity1000ftParcelDensity* with $n=23,822$. A significant regression equation was found ($F(27,23,795) = 17.956$, $p < 0.001$) with an R^2 of 0.020.

After the analysis the 12 coefficients that influence Number of Residences built between 1975-95 the most are found in the table below.

Table 18. Twelve most influential variables for Residential > 1975 and < 1995

Variables	Absolute Value Coefficient
Distance2LavaFlow1250	-.173
Distance2ExistingMF1	-.137
Distance2Airports	.123
Distance2SewerService	-.106
Distance2VolcanoHazard	.079
Intersections1miDensity	-.078
Distance2Schools	.073
Distance2WaterService	.073
Proximity10ftParcelDensity	.064
Proximity1000ftParcelDensity	-.059
Distance2LavaFlow1790	.051
Slope	-.049

Technical Methodology for General Plan Land Use (2020-2024)

County of Hawai'i General Plan

Prepared by:

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Focused Planning Solutions LLC

August 8, 2024

Introduction

Beginning in 2015, the County of Hawai'i Planning Department has been working to update to the General Plan document adopted in 2005. This update has included reviewing and revising the General Plan Land Use map which guides the intended future use of land within the County. This document is intended to provide details on the methodology used to determine appropriate future uses for existing urban, rural, agricultural, and open space areas of the County.

General Plan Land Use

The General Plan is a policy document with a future horizon of 20 years. To help guide growth and development, the General Plan includes a map of intended future use of land throughout Hawai'i County. In the adopted 2005 General Plan, this map is referred to as the Land Use Pattern Allocation Guide (LUPAG). As the County works to adopt the updated plan, the map of proposed future use is being referred to as the General Plan Land Use (GPLU) map to better tie to the General Plan document. GPLU is not the same as the zoning code, also referred to as Chapter 25 of the Hawai'i County Code. The intent of the GPLU is to guide decisions about potential uses of land in a comprehensive way to meet the needs of a growing population in the coming decades. Decisions about zoning and development should be informed by the GPLU and be consistent with the intended uses designated in the GPLU.

2019 Proposed Land Use Map and Revisions

Development of the GPLU for the update began with work in 2015. At that time, the County did extensive analysis to identify existing development, examined the future capacity for development in the County, explored a number of projected growth scenarios, and compared potential outcomes of different growth patterns. This analysis was shared with the public in a series of workshops in 2016 and 2017 to explore community choices of how growth occurs and how County services support different growth scenarios.

The outcomes of that work shaped the policy guidance for establishing a future land use plan designed to encourage growth in urban centers where services are existing or planned. In 2019, a version of the land use map¹ was shared with the public for review and comment. This document provides details on the methodology used to review public comments and revise the 2019 map resulting in the current proposed GPLU map as part of the General Plan 2045 under public review from September 18, 2023 through April 1, 2024.

¹ Future Land Use System Technical Report, Ian Varley, City Explained, Inc., March 10, 2020.



Beginning in the summer 2020, the County and Focused Planning Solutions LLC reviewed the comments to the 2019 proposed future land use map and recommended several revisions to the map at that time. Additionally, new sources of data were explored to help guide proposed revisions. From the review, several considerations were identified to be explored and addressed.

Consideration: The 2019 future land use designations removed Urban Expansion as a designation. Within Urban Growth Boundaries (UGB), LUPAG Urban Expansion areas were defaulted to urban uses, predominantly Low Density Urban. An unintended consequence of this method was some large shifts to urban uses in areas of the County with no planned development in the plan horizon and no existing or planned infrastructure to support such development.

Action: Review all LUPAG Urban Expansion designated areas to determine the criteria for proposed change in future land use. Properties designated as a specific change due to CDP guidance or other area plans were accepted as intended. Properties that were assigned the default urban uses were reviewed for consistency with State Land Use, CDP use, zoning, proposed conservation areas, or other potential plans. In CDPs with future centers identified, urban uses were assigned based on proximity to centers. The criteria used for determining appropriate land use designations:

- Assigned future land use is from an existing plan document.
- Earlier versions of LUPAG show a specific land use, not Urban Expansion.
- Comments from public review propose land uses and County concurs with consistency.
- Area is within a TOD or Center from CDPs.
- Property is under public ownership with intended future use
- Privately owned property has a known area plan
- Where no plan is identified, use existing data for agriculture use, SLUD, access to infrastructure, and/or zoning district to determine appropriate designations.

Following these steps, a determination was made for UE parcels.

Consideration: The 2019 future land use map introduced the Natural Areas designation as a broad category of open space with no intended agricultural use. LUPAG designations of Open and Extensive Agriculture were considered as appropriate candidates to transition to Natural Areas. About 25% of LUPAG is currently classified as Extensive Agriculture. In the 2019 plan, 45% of that land area changed to the Pastoral land use designation based on 2015 UH-Hilo agriculture study of pasture lands and 47% of LUPAG Extensive Agriculture was re-designated to Natural Areas. In current LUPAG, only about 1.4 % of the County is designated Open. About 36% of that land area was re-designated to Natural Areas. Some of these resulting Natural Areas were identified during the review as not consistent with existing or intended property use.

Action: Areas of the LUPAG map currently designated Extensive Agriculture that were proposed to transition to Natural Areas in the 2019 proposed land use plan were reviewed for their existing and planned uses. The following additional data sources were explored to better understand existing and intended future use:



- Carbon Assessment of Hawai'i landcover and habitat analysis (John Jacobi, 2015)
- Historic Lava Flows (HVO, All available years)
- 2015 UH-Hilo Agricultural Baseline crops and pasture data (SDAV, 2015)
- Federal and State Owned Lands from Hawai'i County assessor data

Landcover data was used to define more intentional boundaries for natural areas. The following criteria shaped decisions around the Natural Areas designation:

- State owned lands – retained Natural
- Bare Lands in landcover and historic lava flows – Classified as Natural
- Wetlands in landcover and Cemetery in County Parks – Classified as Natural
- Native dominant use in landcover – Classified as Natural
- Agriculture dominant use – Classified as Agriculture (includes developed, alien forests)
- Pastoral dominant use – Classified as Pastoral

Consideration: 2019 future land use was under review at the same time the 2018 Kīlauea Lower East Rift Zone (2018 LERZ) eruption recovery process was underway. At that time, the area impacted by the eruption was assigned a land use designation of Pending so as not to conflict with concurrent planning processes.

Action: The Pending designations in the 2018 LERZ impact area were reviewed to assign appropriate future uses that would not conflict with the recovery efforts and would appropriately convey the demonstrated risk of the location. The County land area also increased in this area by approximately 766 acres due to the lava flowing into Kapoho Bay and reshaping the coastline in that area. The lava flows were assigned Natural. Island areas surrounded by lava or kīpuka were assigned agricultural use designations to match agricultural studies for productive crop use and or pastoral uses. The Kapoho residential area was also under lava flow. The former urban uses in this area were assigned natural to match these conditions.

Consideration: Parks were not always showing as recreation or conservation.

Action: Data layers for County, State, and Federal Parks were cross-referenced with the proposed land use designations. Park areas not designated as recreation or conservation use were adjusted to match park boundaries. Parks in SLU conservation are noted as GPLU conservation, active parks with active use areas are noted as recreation, and public lands not in active use are noted as natural or conservation, such as PONC properties.

Consideration: Industrial land uses in LUPAG and the 2019 proposed future land use plan were often inconsistent or showed conflicting boundaries with zoning and other plans.

Action: All industrial areas designated in LUPAG, the 2019 proposed land use plan, zoning, CDPs, and other area plans were identified and reviewed to compare boundaries for consistency.



2021 & 2024 Proposed Land Use Map and Revisions

The revisions from the 2019 process were shared in an interactive mapping platform using Esri ArcGIS Online Story Maps. Story Maps provided a universally accessible location to see the proposed land use alongside many other relevant data sets for infrastructure, conservation, hazards, facilities, agriculture, native habitat, and transportation. The Story Map provided an effective way to review proposed changes and digitize comments directly in the mapping application. The County also began using the interactive document platform, Konveio, to review draft General Plan document products and gather community input.

In 2022, a series of working sessions were conducted to review the comments and the proposed changes. At this time, the name of the map was chosen to be the General Plan Land Use (GPLU) map to clarify the connection to the guiding document and purpose of the map. Some revisions to the designations were also made. The final proposed General Plan land uses are shown below in Table 1.

Table 1: General Plan Land Use Designations

General Plan Designation	Changes from 2019 Proposed Plan
Urban Land Use	
High-Density Urban	
Medium-Density Urban	
Low-Density Urban	
Urban Expansion	Added back – after discussion, it was decided to revisit this LUPAG designation
Light Industrial	
Heavy Industrial	
University	
Resort	
Rural Land Use	
Rural	
Agricultural Land Use	
Productive Agriculture	
Extensive Agriculture	Name Change – in the 2019 plan this was referred to as Pastoral Use
Natural	Name Change – in the 2019 plan this was referred to as Natural Areas
Open Space Land Use	
Recreation	
Conservation	



The 2022 working sessions were conducted to review land use designations categorically. Using a live working session format, questions were explored about map designations in real time, identifying areas to flag for review. Comments from the previous online review platform were also reviewed to determine appropriate responses and actions.

In sessions exploring urban designations, uses near centers and development plans were considered. Inclusion of the Urban Expansion designation as a proposed land use provided an opportunity to revisit appropriate locations for that use:

- Review areas of LUPAG within Urban Expansion.
- Look at undeveloped existing land use
- Exclude areas that are already at capacity, map those at the capacity
- Exclude state owned conservation, critical habitat, county parks.
- Within TODs, use the appropriate high or medium urban designations.

The next sessions explored rural and agriculture uses for consistency with State Land Use, zoning, and the 2020 UH-Hilo Agriculture data. Conservation and Natural areas were reviewed for consistency with State Land Use, native habitat landcover data, and area plans for conservation. These review sessions highlighted areas for potential changes to better align with intended criteria.

After incorporating recommendations to the GPLU map in the spring-summer 2023, an interactive mapping platform was designed to provide a single location for public users to review the proposed map and add comments. The mapping platform links to the Konveio General Plan document review platform directly, allowing users to derive document searches from the map and to query the map based on questions in the document. The public review process concluded on April 1, 2024. Over 200 comments were provided on the GPLU maps. From the public review process, a few considerations were identified and reviewed.

Consideration: Some areas assigned Urban Expansion land use are currently developed as urban.

Action: Review existing development in Urban Expansion to identify areas that are built or at capacity and assign consistent urban designations.

Consideration: The Kona CDP identified areas at high elevation for consideration of protection to help with water protection, landslide risk, and native habitat.

Action: Review lands in the County above 2,500 feet elevation for possible Natural designation. Property in public ownership identified for Natural designation.

Consideration: Lands identified by the Public Access, Open Space, and Natural Resources Preservation Commission (PONC) should be designated as conservation lands.

Action: Map the PONC lands and reclassify to Conservation Land Use.

Consideration: The coastal buffer for the island was initially proposed to have Recreation as the universal designation. Many coastal areas are in SLUD Conservation areas.



Action: Review coastline for SLUD classification. Convert SLUD Conservation and Agriculture to GPLU Conservation. Confirm SLUD Urban as GPLU Recreation.

Results

Appendix B provides the graphic analysis of changes in land use from adopted LUPAG through the proposed GPLU. The land use comparisons demonstrate the County policy goals to increase Conservation and Natural uses, retain Productive Agriculture, reduce or more specifically define urban footprints, and provide more areas for Rural.



Appendix A – List of Additional Data and Sources

HVO, U. (All available years). Past and Present Lava Flows for Hawaii Island.

John Jacobi, U. P. (2015, 01 01). Carbon Assessment of Hawaii Habitat Status. Retrieved from <https://www.sciencebase.gov/catalog/item/592dee75e4b092b266efeb6e>

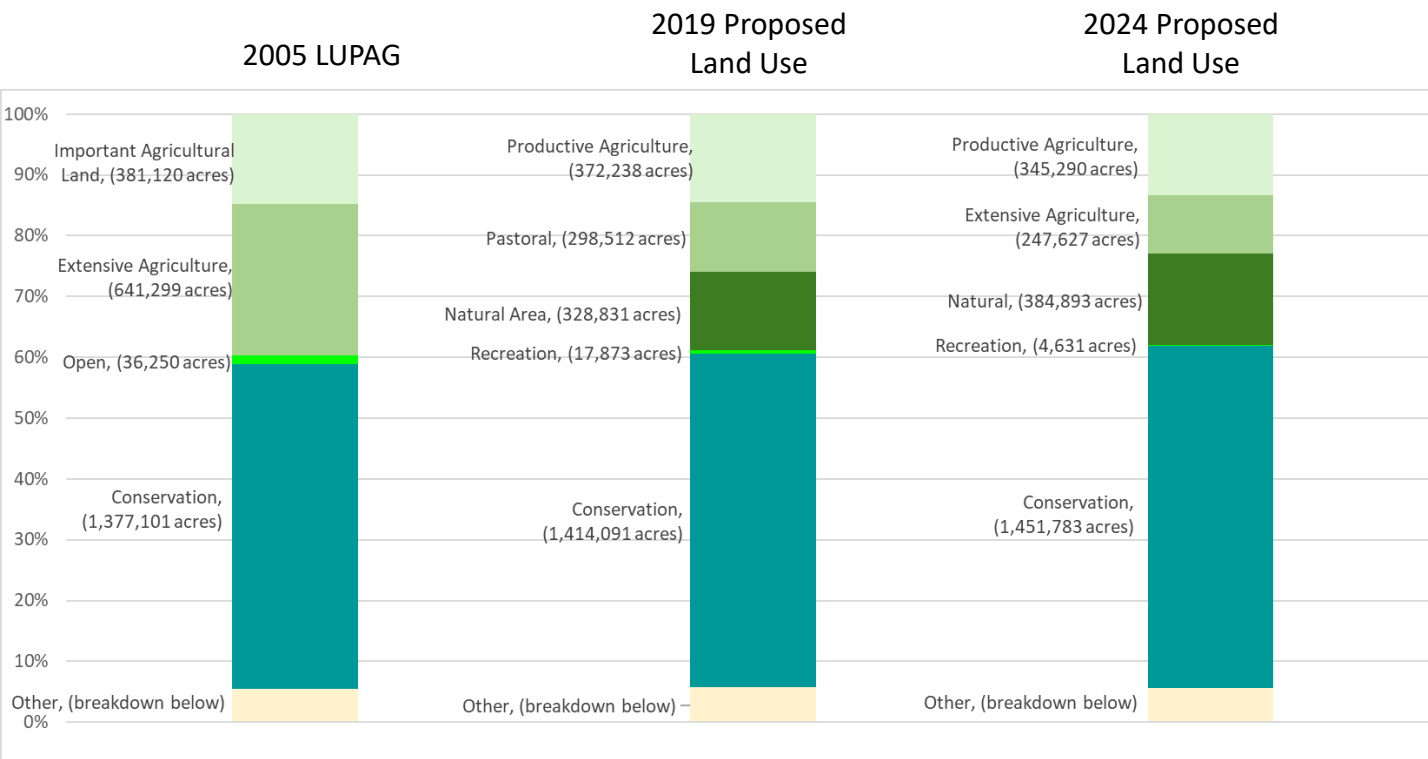
SDAV. (2015). 2015 Hawaii Statewide Agricultural Land Use Baseline layer.



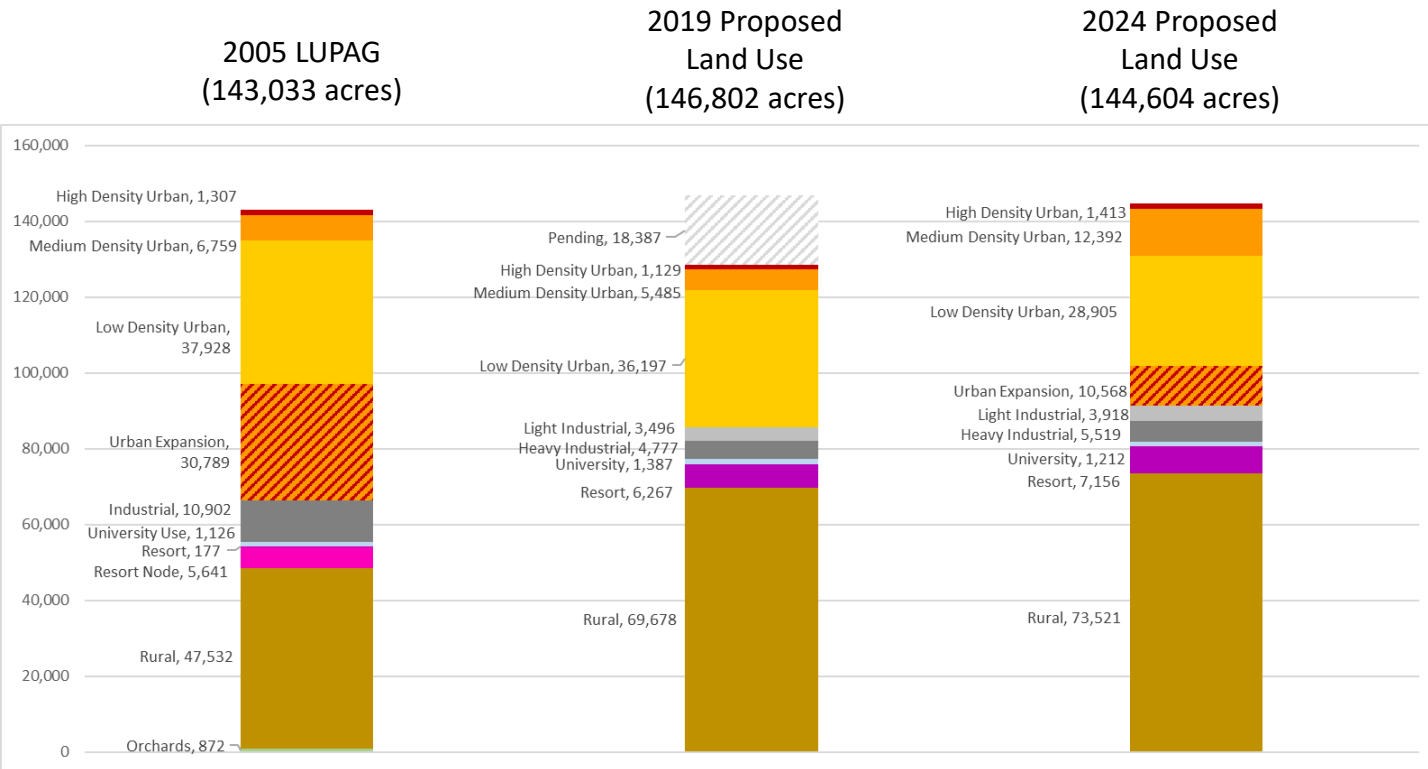
Appendix B: General Plan Land Use Changes by District



Hawai'i County
(approximately 2,578,828 acres)

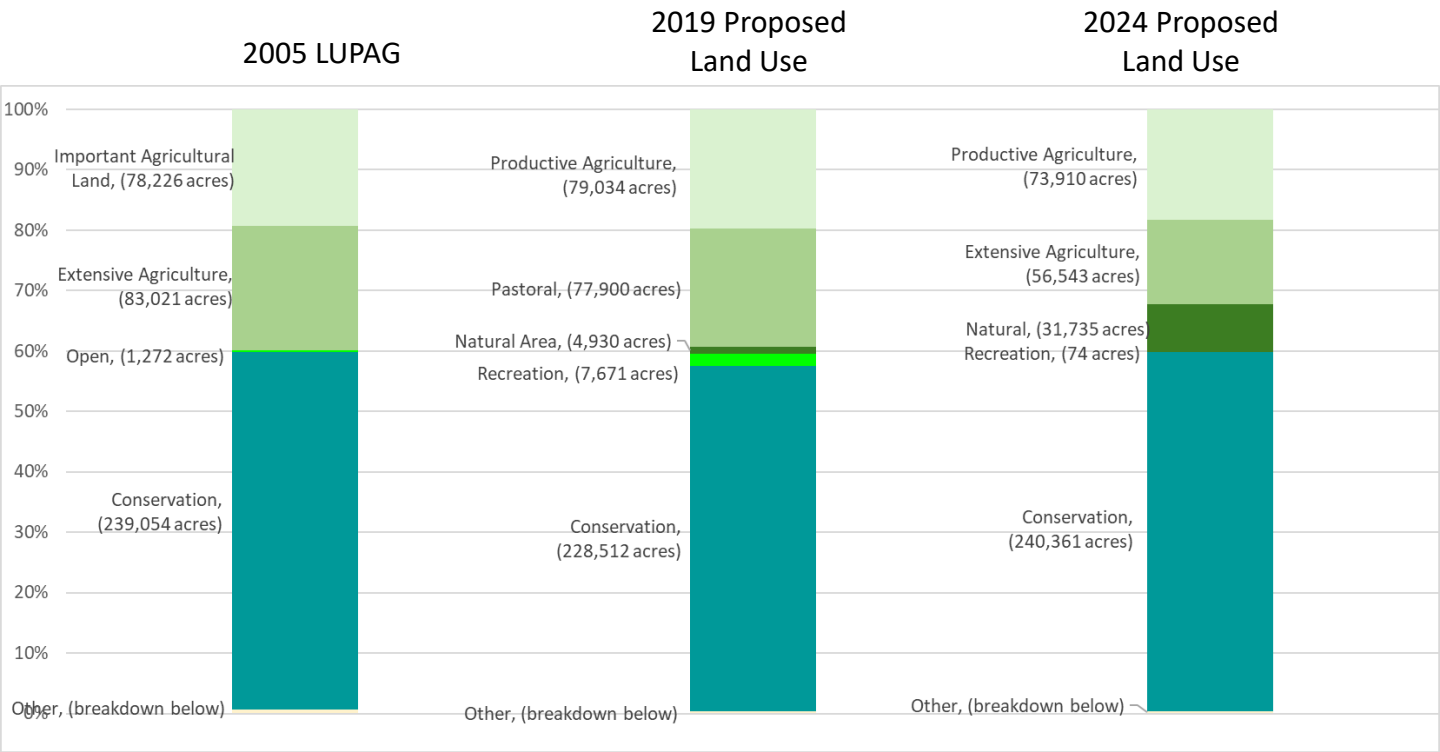


Hawai'i County
Breakdown of Other Land Use Types



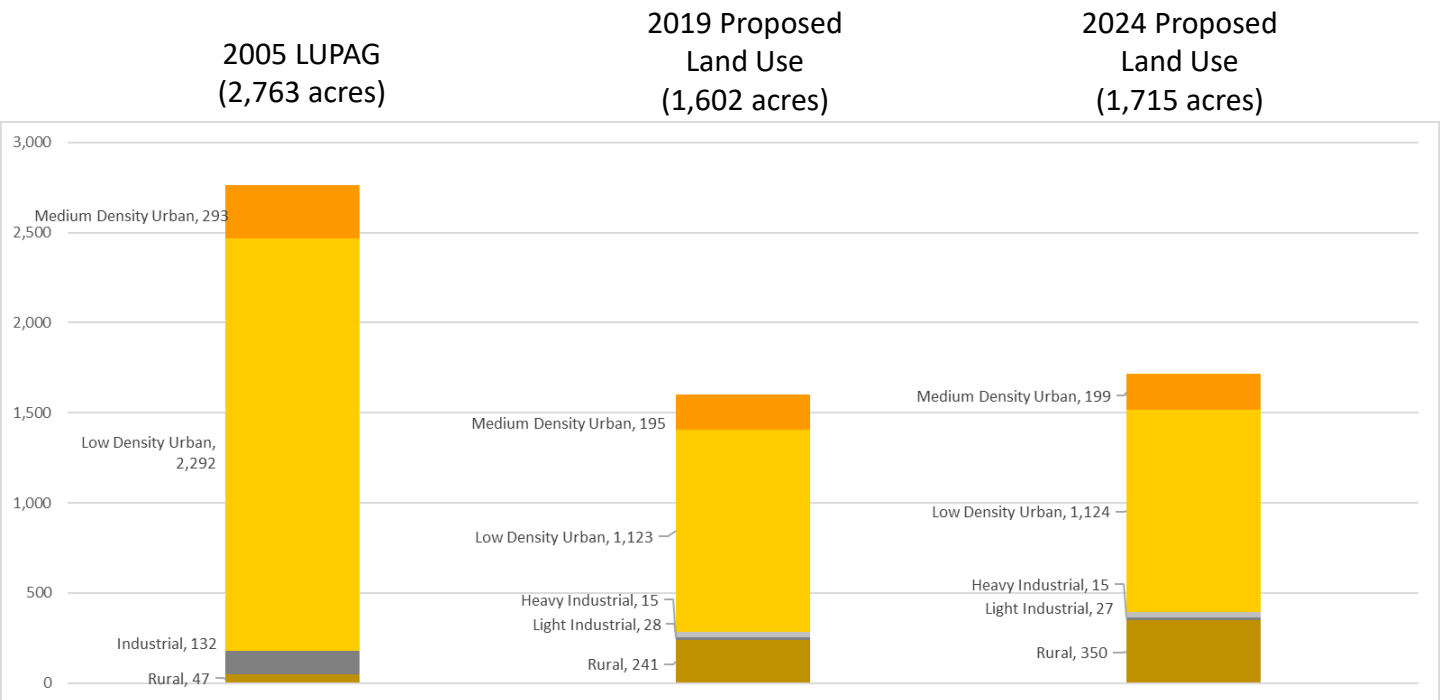
Hāmākua

(approximately 404,337 acres)

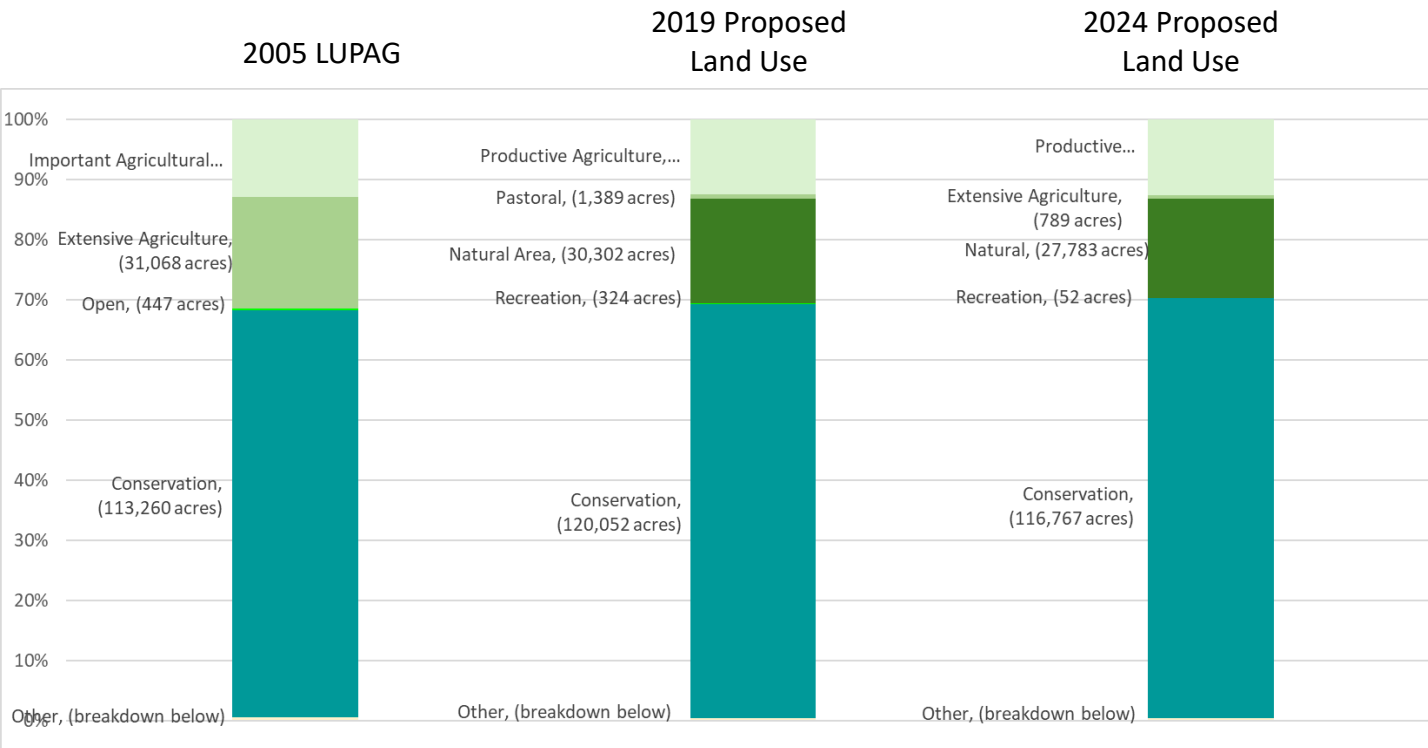


Hāmākua

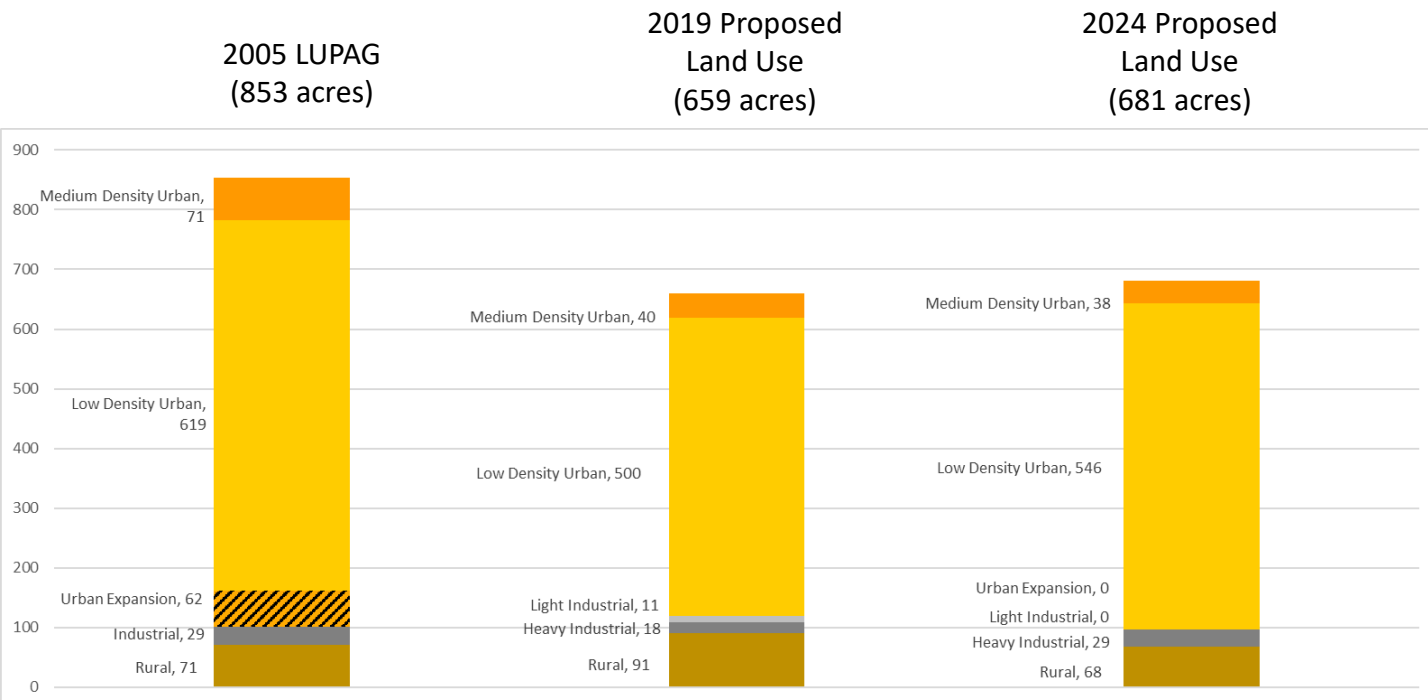
Breakdown of Other Land Use Types



North Hilo (approximately 167,230 acres)

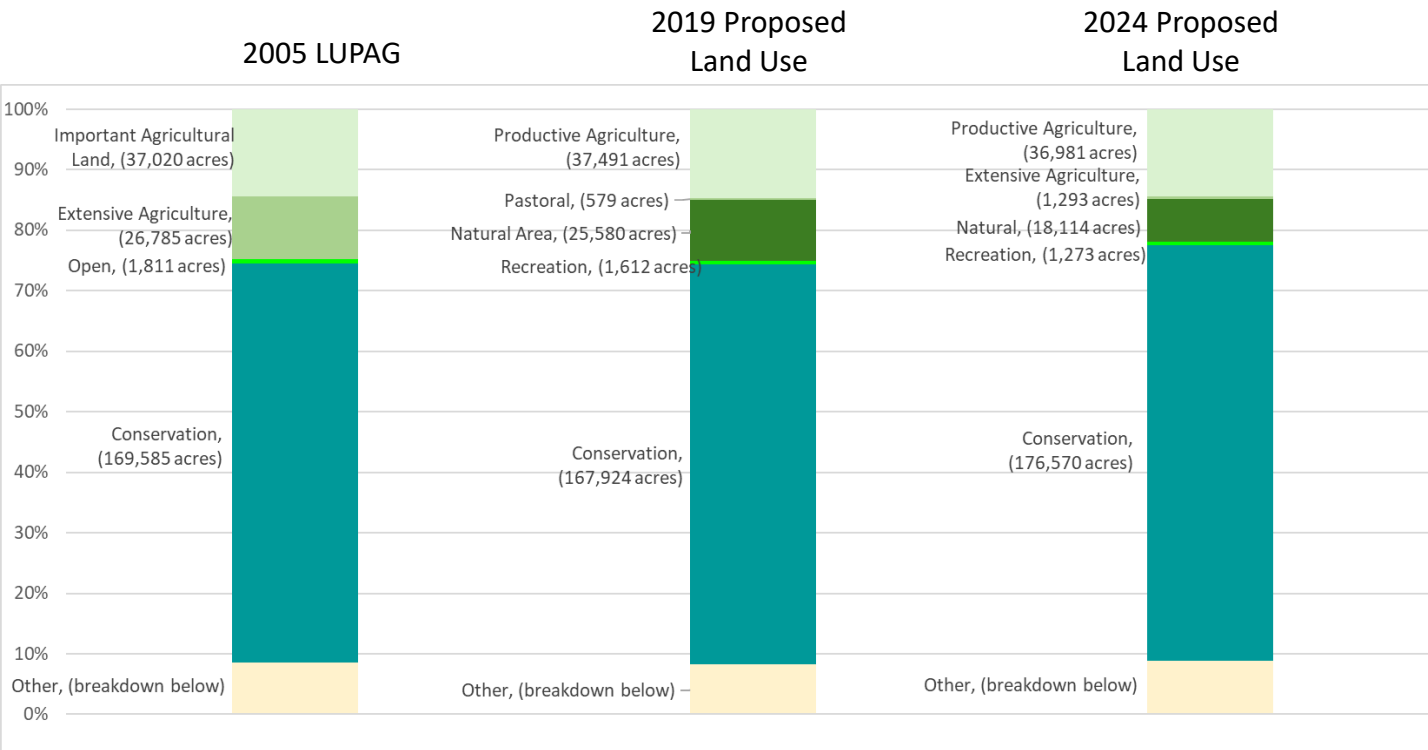


North Hilo Breakdown of Other Land Use Types



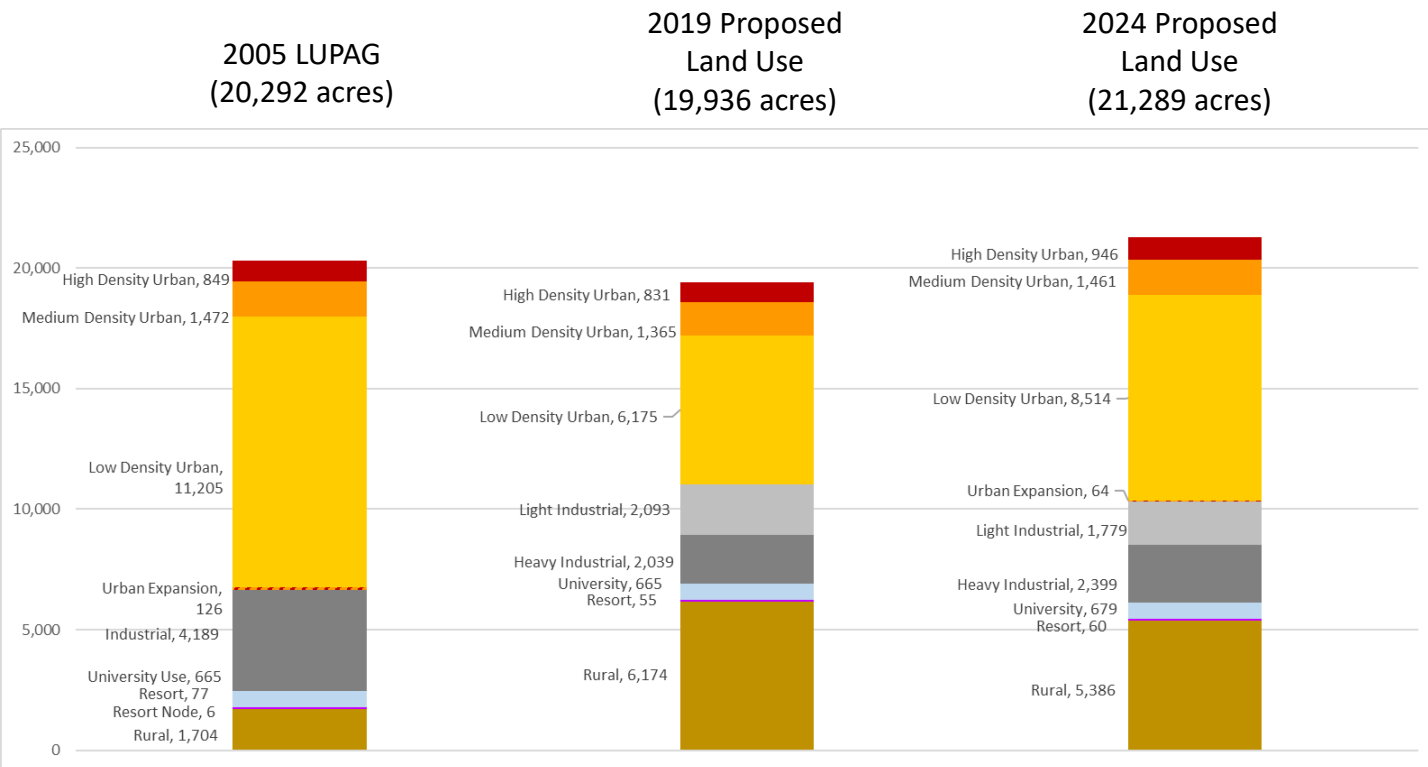
South Hilo

(approximately 255,518 acres)



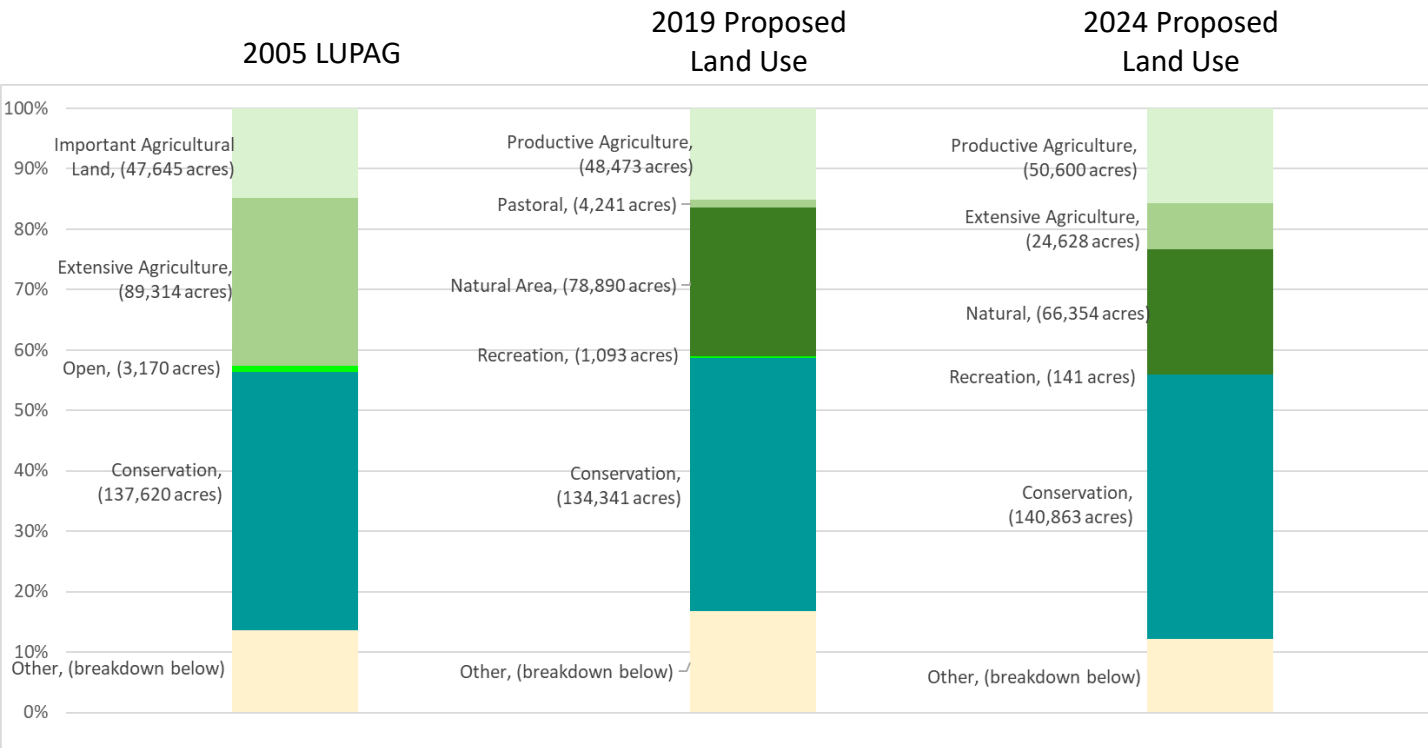
South Hilo

Breakdown of Other Land Use Types



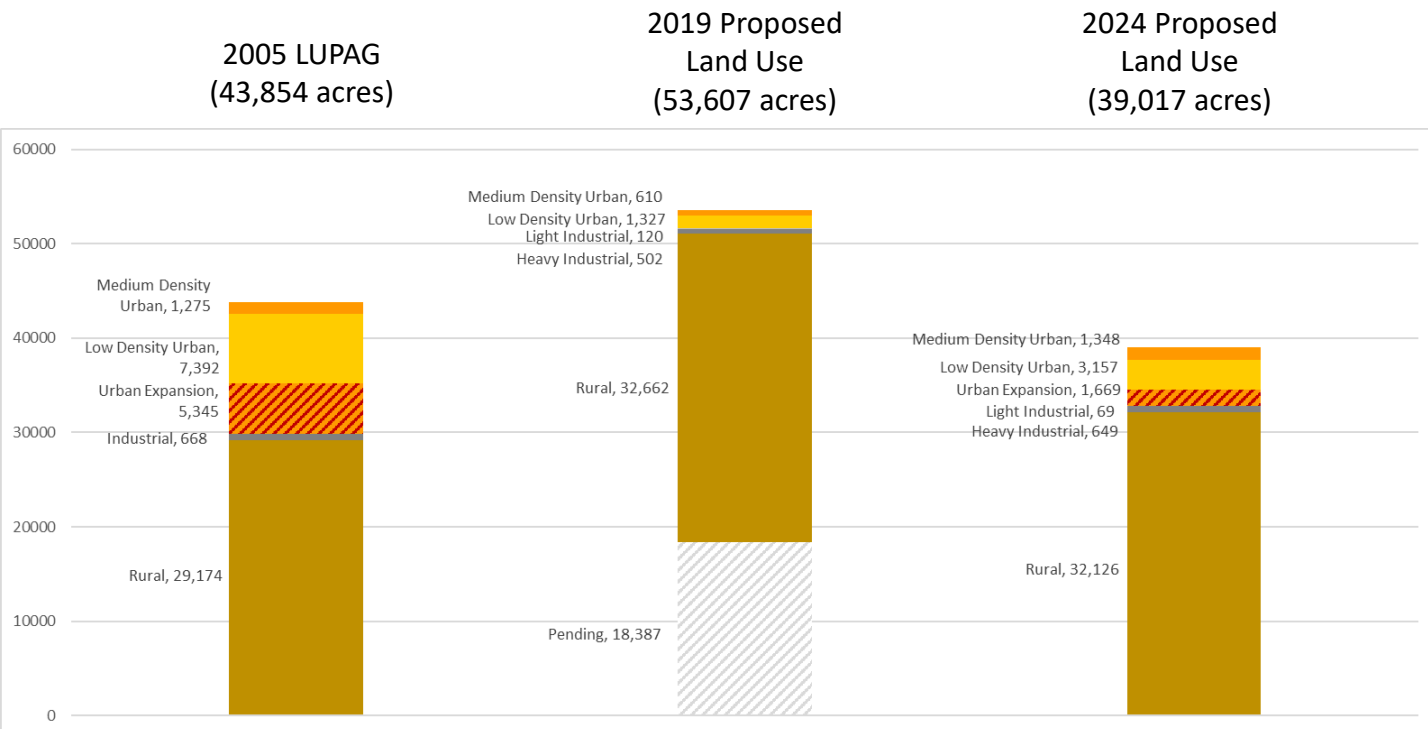
Puna

(approximately 321,604 acres)



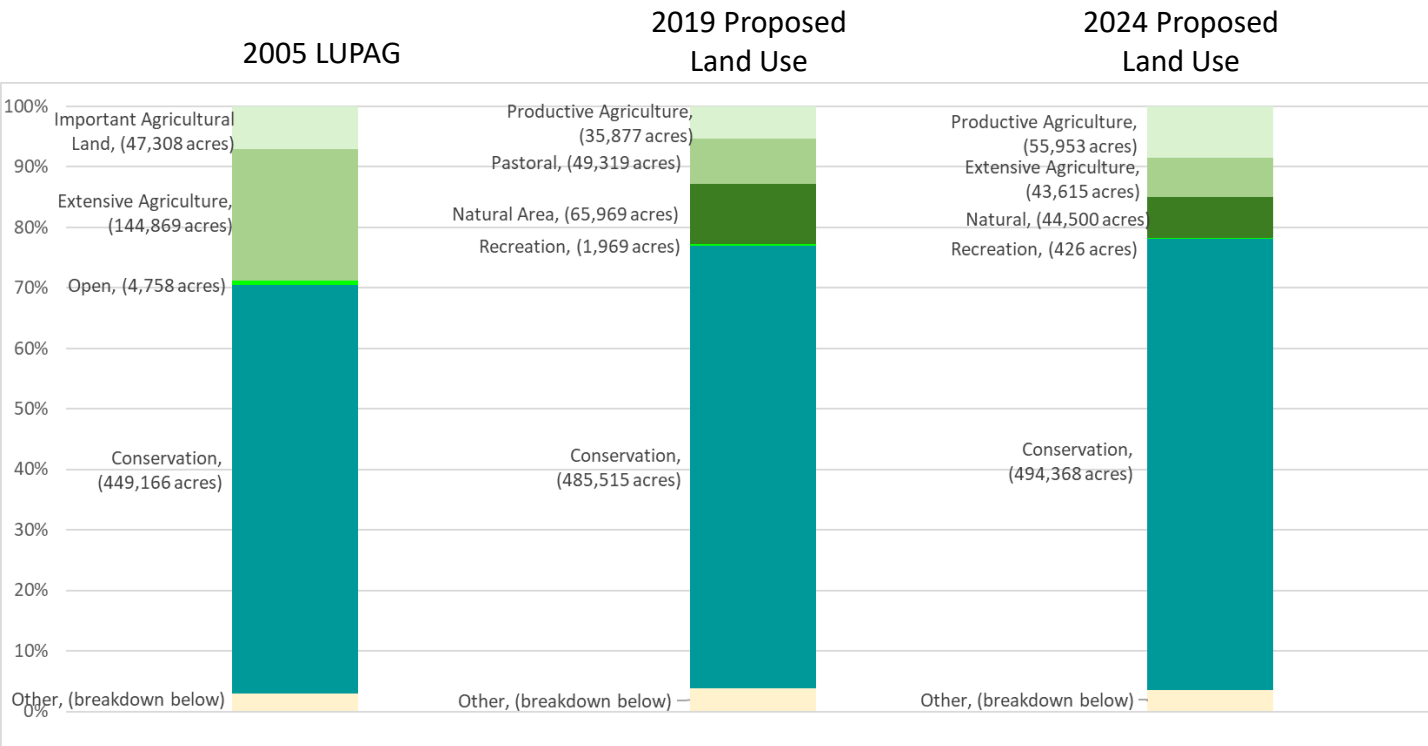
Puna

Breakdown of Other Land Use Types



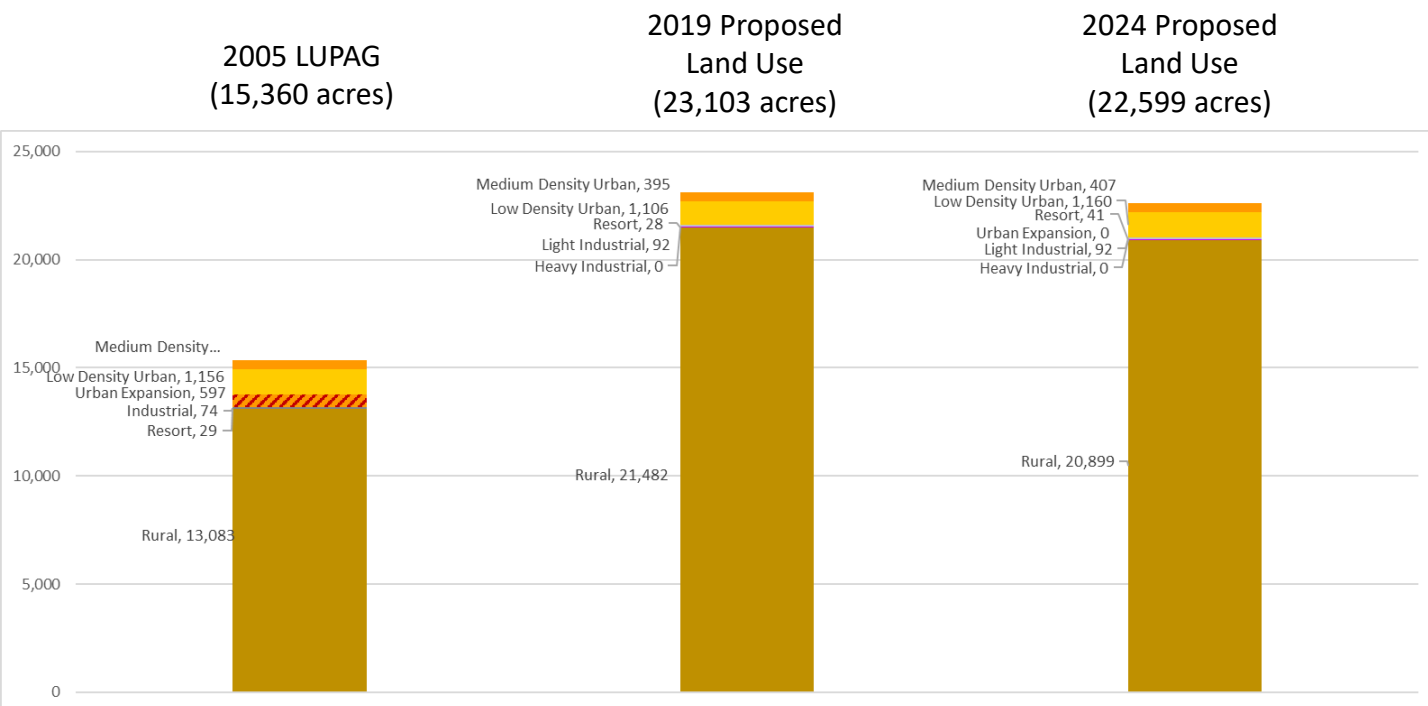
Ka'ū

(approximately 661,461 acres)

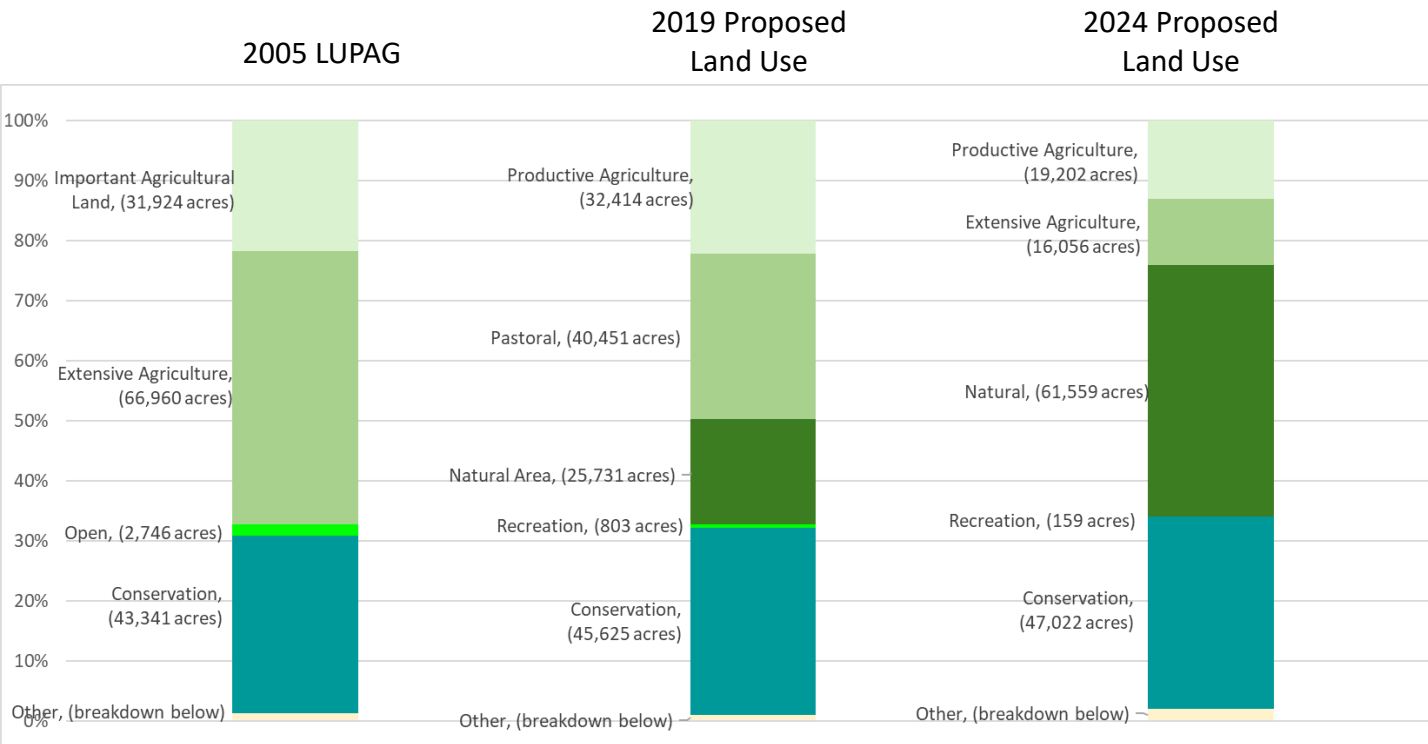


Ka'ū

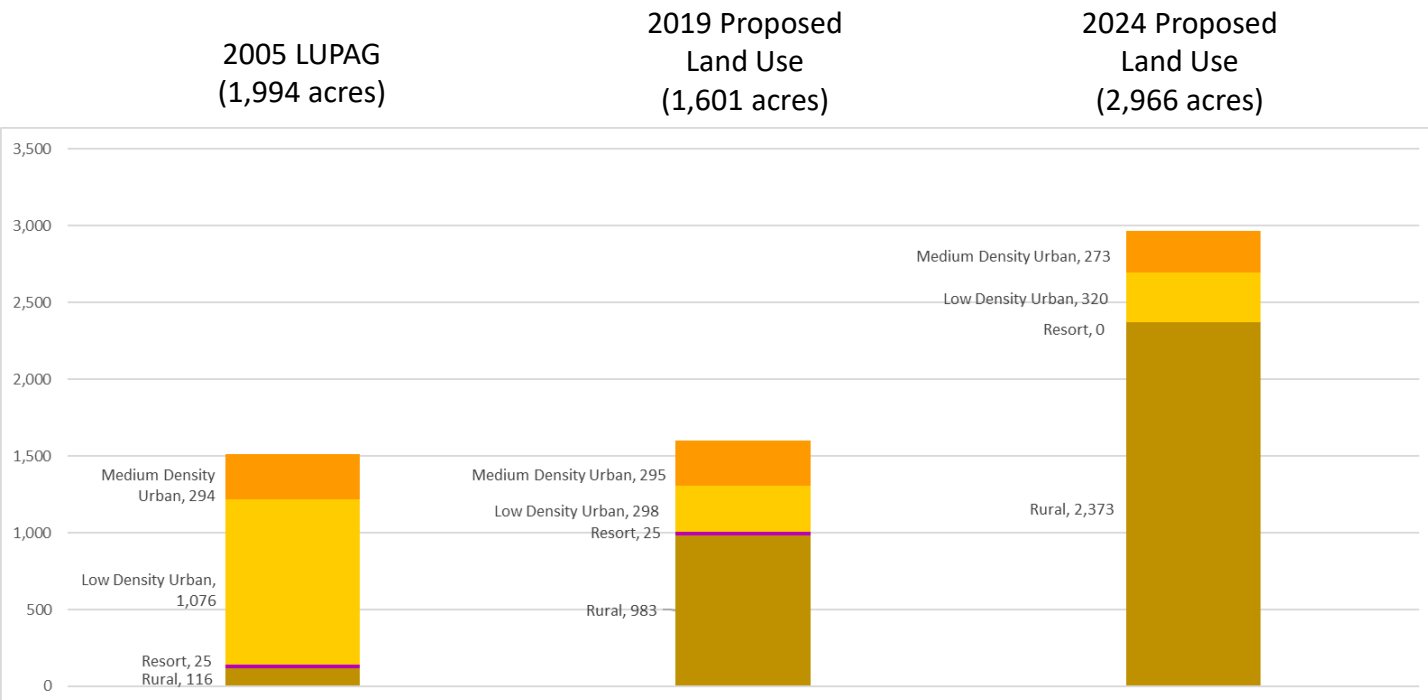
Breakdown of Other Land Use Types



South Kona (approximately 146,964 acres)

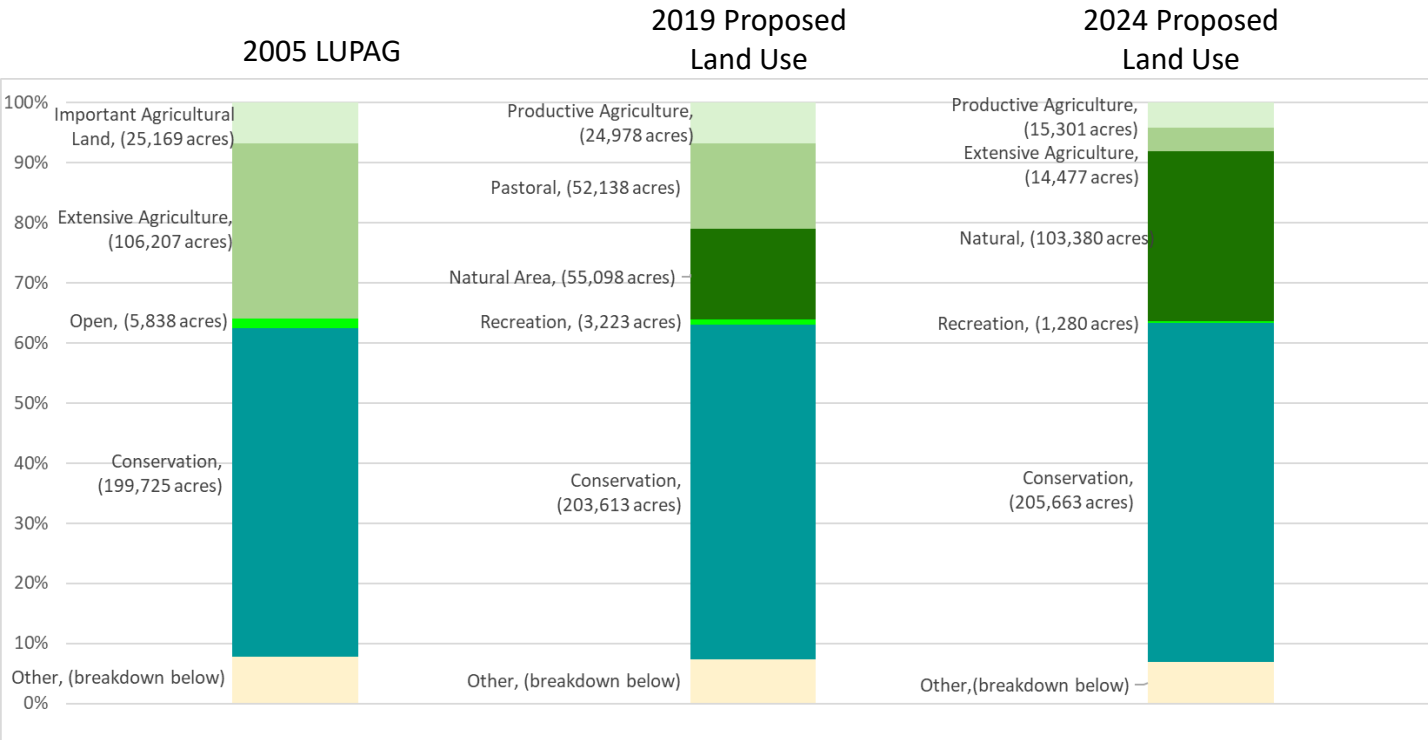


South Kona Breakdown of Other Land Use Types



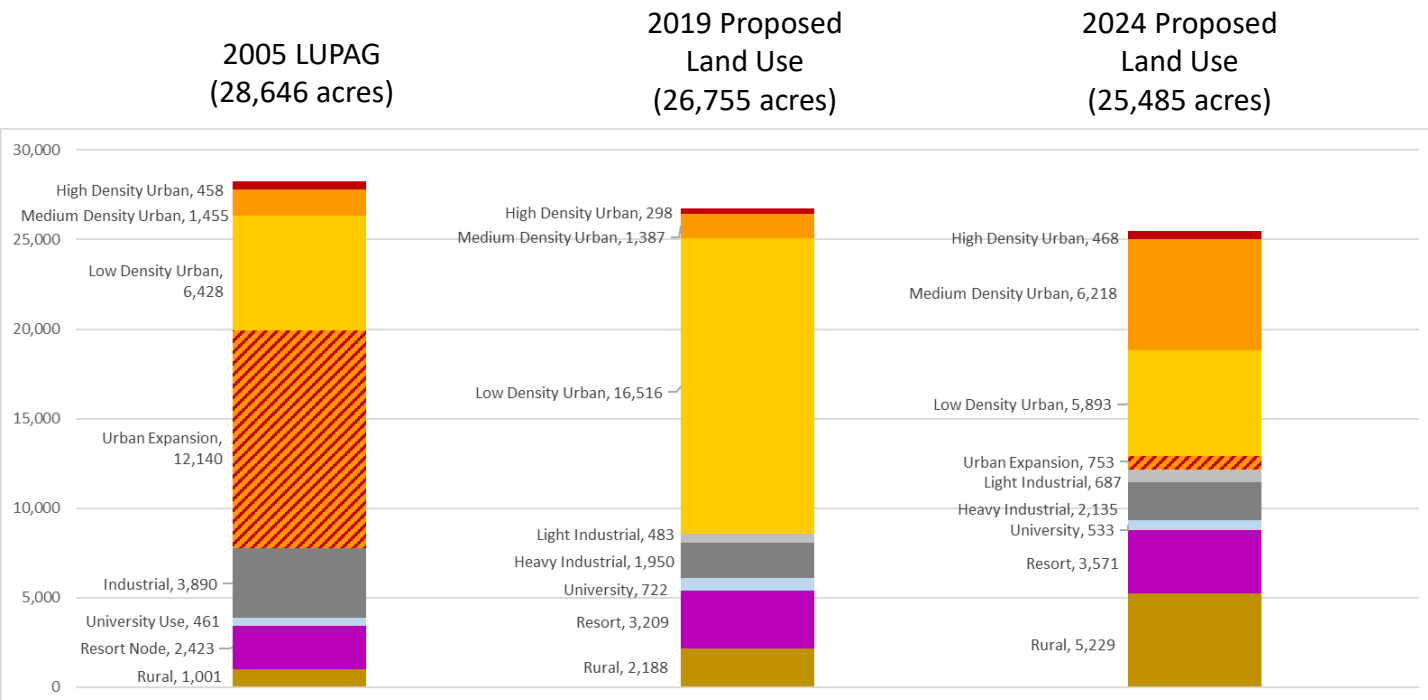
North Kona

(approximately 365,585 acres)



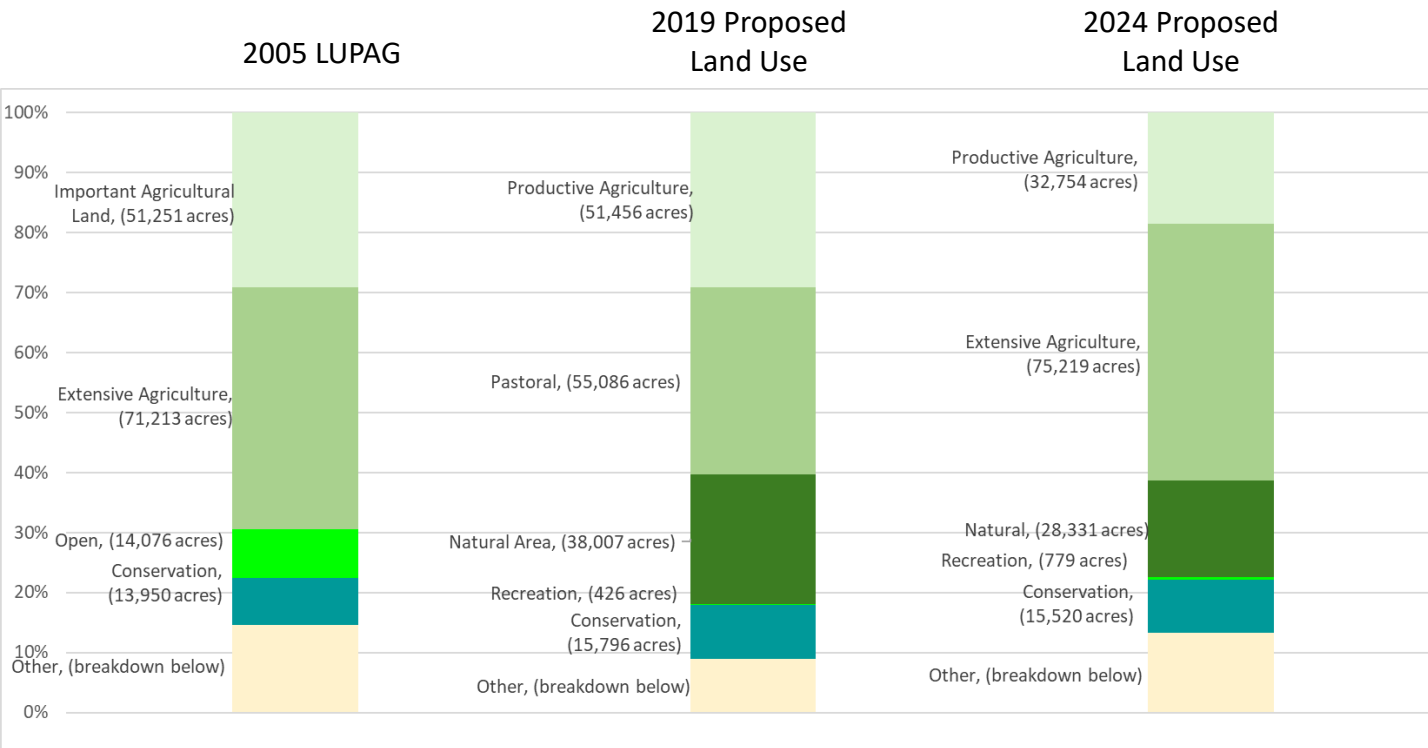
North Kona

Breakdown of Other Land Use Types



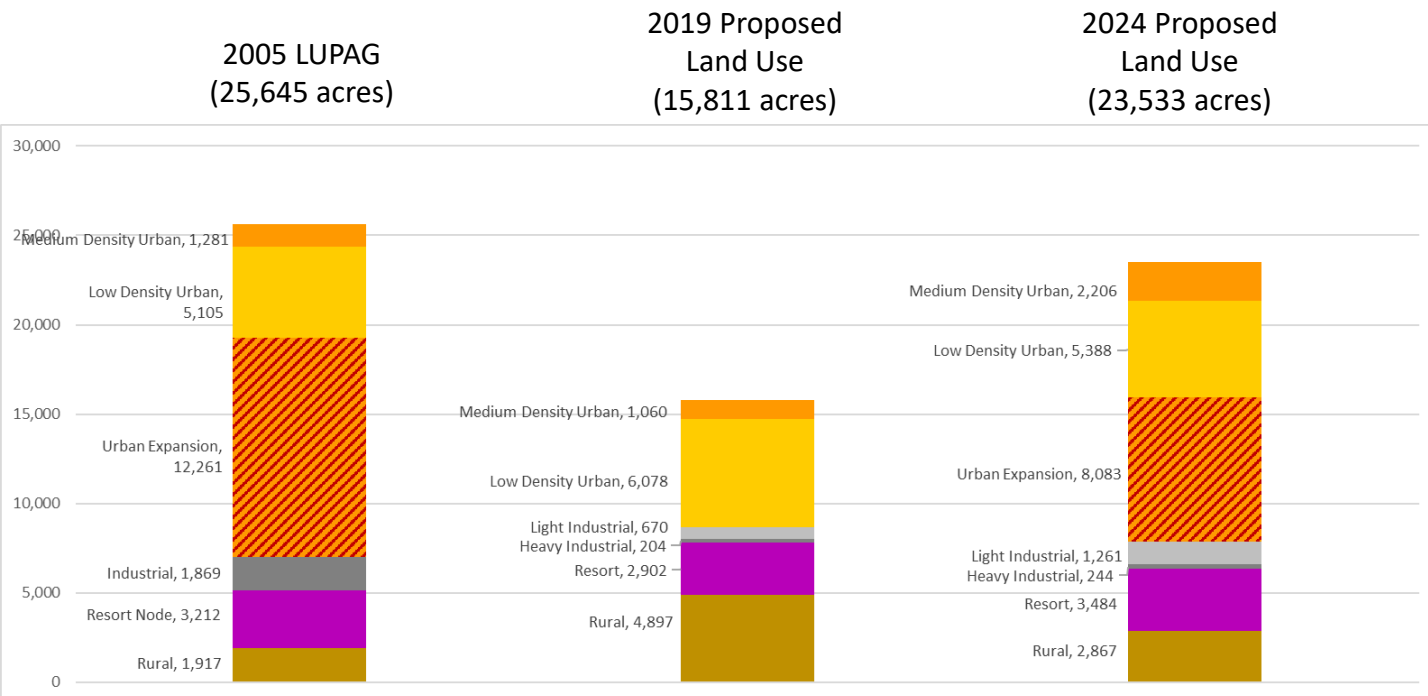
South Kohala

(approximately 176,135 acres)



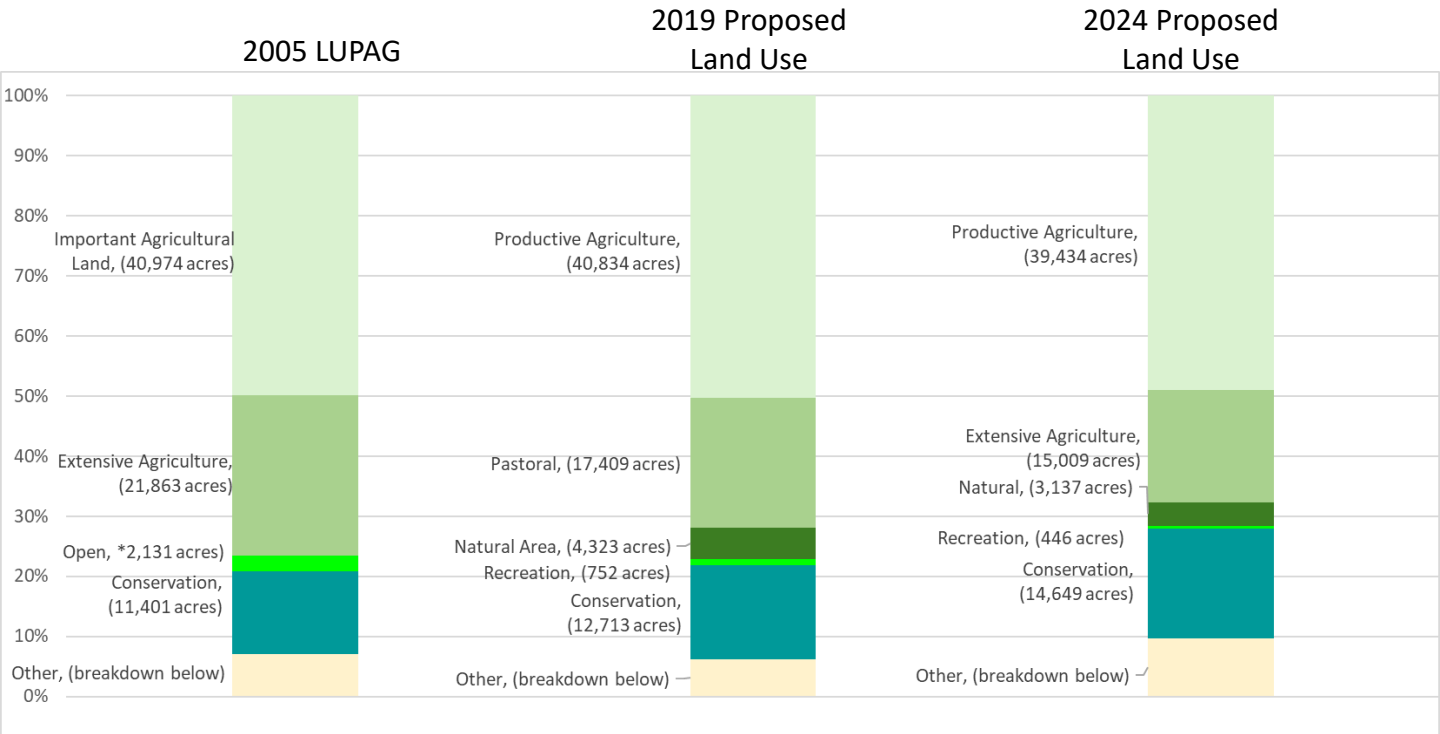
South Kohala

Breakdown of Other Land Use Types



North Kohala

(approximately 79,993 acres)



North Kohala

Breakdown of Other Land Use Types

