Alternatives Analysis: Runway Feasibility Study

Executive Summary

The intended purpose of the Runway Feasibility Study is to analyze and identify the runway configuration, existing or new, that will result in the least noise, annoyance, and overflight impacts to the Truckee Tahoe Airport (TRK) community and residences in the airport's vicinity. The primary goal is to consider alignment alternative options that accommodate demand at TRK but also reduce residential overflight in its vicinity. The Study revealed these key findings:

- **Alternative 1 and Alternative 2 both meet the primary goals of reducing overflight and minimizing noise impacts to residences in TRK's vicinity compared to Existing Conditions.**
- **Alternative 3 and Alternative 4 are not recommended for further study beyond this report.**

Evaluation criteria, other than residential noise and overflight, include impacts to existing airfield facilities, operations, the environment, and construction costs. While Alternative 1 and Alternative 2 meet the primary goal in the aggregate, both come with significant capital costs and impacts to the airfield. To implement either alternative, these costs and impacts will need to be weighed against the benefits.

The Study recommends the District review and consider Alternative 1 and Alternative 2 as possible options to reduce noise, annoyance, and overflight impacts. Both Alternative 1 and Alternative 2 offer noise and overflight improvements but include varying capital costs and impacts. For instance, Alternative 1 offers improved approach and departure capabilities, but has higher cost estimates for construction, plus significant impacts on existing airfield facilities. Alternative 2 does not impact existing facilities and has lower cost estimates for construction than Alternative 1, but does not offer improved approach capabilities, and capital costs are still significant.

While Alternatives 1 and 2 reduce noise and overflight in the aggregate, both configurations shift impacts at varying degrees to other neighborhoods (Alternative 1 does provide slightly greater reduction in noise and overflight). Neither of these options are assured of FAA support based on current Airport Improvement Program (AIP) standards.

Alternative 3 and 4 are not recommended for further study for related reasons. Alternative 3 reduces runway length while not significantly reducing residential overflight and noise compared to Existing Conditions. Alternative 4, which contains a component of Alternative 3, does not significantly reduce residential overflight and noise compared to Alternative 1.

The Runway Feasibility Study contains detailed analysis of four runway alternatives and multiple Appendices describing background effort and data. While this Study relied on various assumptions, these assumptions were derived from extensive pilot outreach and interviews, TRK staff review and input, airport traffic control input, local experience, and consulting with various subject matter experts. The analysis within is based on this available data.

The Draft Feasibility Study is submitted to the Truckee Tahoe Airport District (TTAD) for review and comment. After TTAD review, feedback and comments will be incorporated into the Final Draft Feasibility Study. The Final Draft will include a recommendation and decision point for the preferred runway alternative. The preferred alternative will be a critical component to consider in Phase 2 of the Master Plan Update project.

RUNWAY FEASIBILITY STUDY SECTION OVERVIEW

- **Executive Summary**
- **Introduction**
- **Runway Alternatives Summary**
- **Alternative Runway Utilization Estimates**
- **Noise Analysis**
- **Runway Alternatives Analysis**
- **Runway Alternatives Summary and Next Steps**
- **Appendices**

Introduction

The Truckee Tahoe Airport District (TTAD), sponsor of the Truckee Tahoe Airport (TRK), is updating the Airport Master Plan (AMP). The last AMP was completed between 2013 and 2015 with TTAD Board acceptance in 2015. The primary goal of this AMP Update is to evaluate the future disposition of the TRK airfield. This process will involve analysis of several runway development options and alternatives to assess and quantify the potential benefits to the community surrounding TRK in terms of reduced noise and annoyance and reduced aircraft overflight in areas of residential development. Ancillary benefit analysis may include the reduction of greenhouse gas emissions and enhanced safety. The preferred alternative from this analysis will likely be carried forward into an environmental project, and this AMP Update will be structured to facilitate the transition from planning to environmental analysis.

Before taking any action related to a third runway or any preferred alternative airfield configuration, TTAD must first update the adopted TRK Airport Layout Plan (ALP). Building justification for the airfield improvements requires an AMP Update with a Feasibility Study that shows the planning that supports the change, including how impacts to existing facilities that are eligible for Federal Aviation Administration (FAA) funds will be met and how FAA airfield geometry standards will be followed. The AMP process will provide TTAD an opportunity to further evaluate the purpose for the third runway, perform public outreach, refine the layout of the conceptual runway and parallel taxiway, and determine how the runway will be integrated with the existing airfield and airport operations.

The AMP Update will also provide a means for TTAD to officially engage with the FAA. The FAA will not begin the federal environmental review process until the AMP Update is completed, and the agency has formally approved/signed the associated ALP. The FAA also leads the environmental review for a federally sponsored project, whether this is TTAD or federally funded: the federal agency carrying out the federal action is responsible for complying with requirements of the National Environmental Policy Act (NEPA).

The AMP Update will be prepared following FAA standards and guidance so that the ensuing capital program is positioned for FAA funding eligibility, and so that TTAD continues to meet FAA Grant Assurances that they have previously accepted. Key FAA guidance includes:

- FAA Advisory Circular (AC) 150/5300-138, *Airport Design* (AC-13B)
- FAA Order 5100.38D, Change 1, *Airport Improvement Program Handbook* (AIP Handbook)
- FAA AC 150/5000-17, *Critical Aircraft and Regular Use Determination*
- FAA AC 150/5070-6B, Change 2, *Airport Master Plans* (AC-6B)
- Federal Regulation Title 14 Part 77, *Objects Affecting Navigable Airspace, Section 25, Civil Airport Imaginary Surfaces* (Part 77)
- FAA Order 8260.3D, *United States Standard for Terminal Instrument Procedures* (TERPS)

RUNWAY FEASIBILITY STUDY AND PHASE 1

The AMP will be separated into two phases. Phase 1 will focus on the third runway with this Runway Feasibility Study. Phase 1 of the AMP Update also includes Airside Facility Requirements. Phase 2 will integrate the Phase 1 findings and further evaluate impacts based on the Preferred Runway Alternative and geometry on the airfield and existing facilities. Phase 2 of the AMP may also evaluate other airside facilities, landside facilities, land use, airport sustainability, and property interest considerations.

Existing Conditions

This AMP Update was commissioned by the TTAD Board as a tool to engage with the community and respond to community concerns over noise, safety, and overflight of residences near TRK. Developing a third runway, lengthening Runway 02/20, or other airside improvements are not in response to a capacity issue at TRK. The 2015 AMP demonstrated the Airport will meet existing and future capacity needs for years to come.

A Forecast Update was completed in 2021 and shows 39,621 operations in calendar year 2019, which includes touch-and-go and glider operations. The year 2019 was used as the base year for the Forecast Update since this study was completed during the COVID pandemic. The year 2019 represented the last year of complete data where operations were not affected by the pandemic. The 2015 AMP forecasts showed 31,139 operations in 2025. The Forecast Update in 2021 resulted in projected operations of 42,352 in 2025, and 46,986 operations in 2040.

TRK is well under FAA-calculated capacity since the Airport is limited by factors such as the longest runway, terrain, and weather that in turn limit the number of operations and the type of aircraft using TRK. The Airport does not support commercial airline Part 121 operations, and no work is currently underway to facilitate such operations. This lack of commercial service, along with comprehensive air service located at RNO just 30 minutes away, also limits demand.

How did we get here today?

Since 2015 the Third Runway concept has continued to be a subject of public interest:

2013 - 2015: Airport Master Plan

- Third runway was briefly reviewed but not pursued due to cost and likely ineligibility for federal funding
- RW 2/20 lengthening and widening became preferred alternative

2019 - 2020: Third Runway Preliminary Analysis:

- Evaluated FAA eligibility potential for Third Runway
- Described steps to bring this to the FAA, funding, and environmental review

In 2021 the Board decided to pursue a full Runway Feasibility Study to fully vet the concept

Why does evaluating the Third Runway matter?

- Potential benefits to the community and operators
- Due diligence

This Feasibility Study and evaluating a third runway project is not in response to a capacity issue. This Feasibility Study is concerned with shifting a portion of traffic from the primary Runway 11/29, and if this will reduce residential overflight, noise, and annoyance. Runway 11/29 will remain the longest runway at TRK; this Study does not propose a runway longer than Runway 11/29. TRK will remain limited by aircraft capable of using Runway 11/29. Adding a third runway or lengthening Runway 02/20 will not increase the ability for larger aircraft to operate at TRK.

RUNWAY FEASIBILITY STUDY GOALS

The intended purpose of the Runway Feasibility Study is to analyze and identify the runway configuration, existing or new, that will result in the least noise, annoyance, and overflight impacts to the TRK community and residences in the vicinity of the airport. The primary goal of this analysis as part of the AMP update is to consider runway alignment alternative options to reduce residential overflight in the vicinity of TRK. While the current configuration of Runways 11/29 and 2/20 meets FAA safety and design standards, the options considered may have the added benefit of further enhancing airport safety in the area around the Airport as well as approach and departure corridors. The alternatives will be analyzed against the others for noise, overflight, and how each affects residence in the community. The primary goals of the analysis will be to find the airfield configuration that:

- Reduces residential overflight
- Reduces noise impacts on residences
- Shifts arrival and departure operations to areas away from neighborhoods
- Minimizes effects on existing airfield facilities
- Analyzes quietest and most efficient approach and departure flight procedures
- Minimizes environmental impacts
- Avoids facilitating more operations at TRK
- Receives support from the FAA.

This Feasibility Study will quantitatively and qualitatively compare the alternatives based on criteria to meet the goals established above. Four "build" alternatives will be evaluated plus one "no-build" alternative that evaluates criteria based on the existing runway configuration. It is possible the no-build alternative may be found to meet the goals established, and therefore no action may be considered.

Operations used for the alternative analysis include operations from June 2020 to July 2021. Operations data and conditions are explained in more detail in the Operations for Alternatives section later in this report.

Runway Alternatives Summary

The Study established four alternatives that alter the runways and airfield composition and a no-build scenario. These runway alternative configurations will be evaluated on the scoring and criteria established to meet TTAD established goals.

- Alternative 1 – Third Runway (Runway 16/34)
- Alternative 2 – Runway 02/20 Extension and Widening (2015 AMP preferred)
- Alternative 3 – Runway 11 Displaced Threshold
- Alternative 4 – Third Runway and Runway 11 Displaced Threshold
- No Build

RUNWAY ALTERNATIVES SYNOPSIS

This section describes the four runway alternatives analyzed in this Feasibility Study, and the No-Build scenario. **Figure 4-1** shows the sketches for the four build alternatives.

Alternative 1 – Third Runway (Runway 16/34)

Alternative 1 is the conceptual third runway. Runway 16/34 is 5,900 feet long and located on existing TRK property. To maintain standard runway safety areas, the threshold for Runway 29 shifts 485 feet to the west, and declared distances are proposed on Runway 11/29 to maximize operational length.

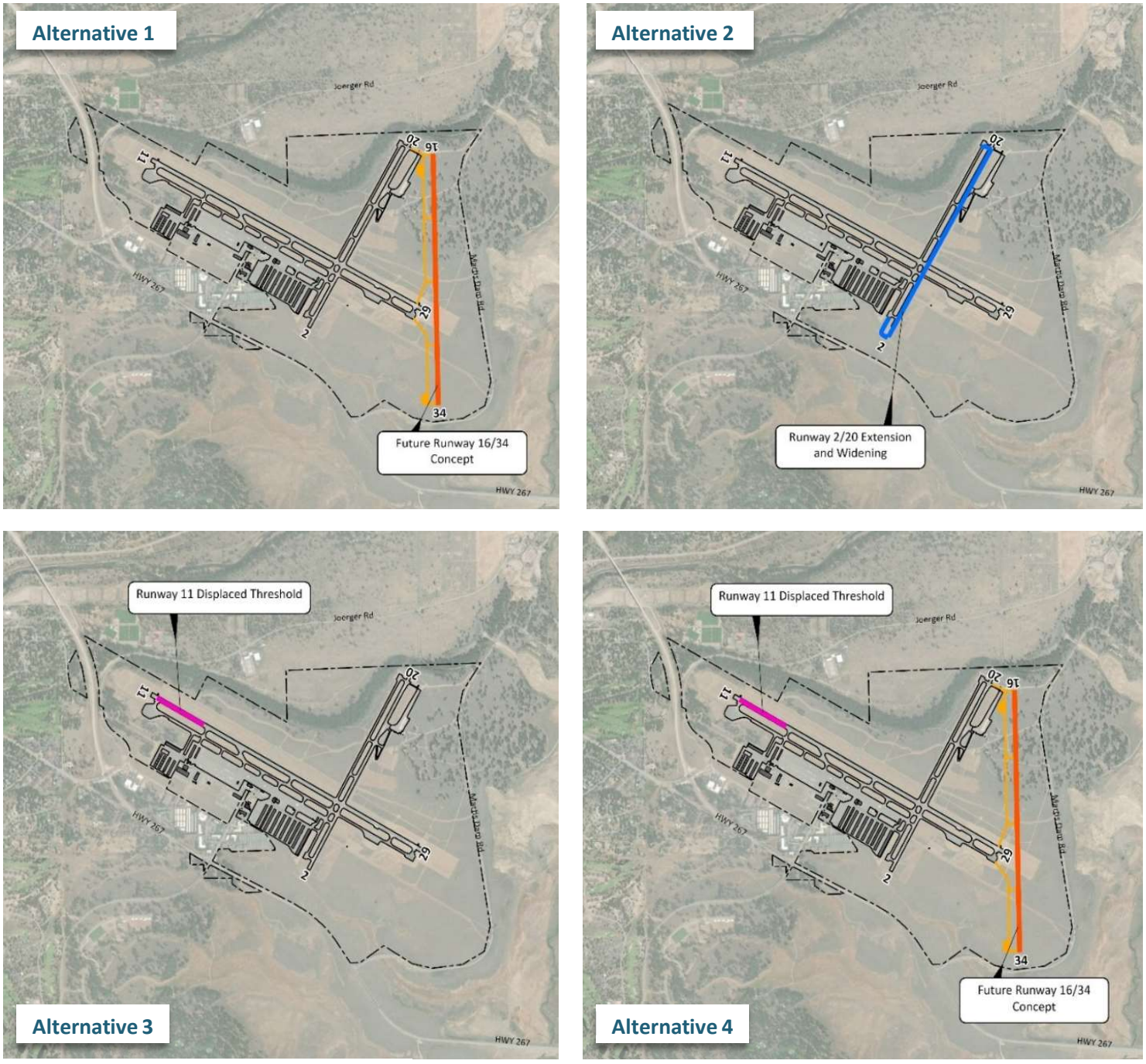
Access to the approach end of Runway 34 is from Taxiway A extending beyond the arrival end of Runway 29 to a taxiway parallel to Runway 16/34. The approach end of Runway 16 may be accessed by crossing the approach end of Runway 20 from Taxiway G and extending the connector taxiway to a taxiway parallel to Runway 16/34.

The Preliminary Siting Study for Runway 16/34 finalized the location of the third runway for this evaluation. The study analyzed Runway 16/34 to be located on existing TRK property, maintain standard runway safety areas and other critical design areas and surfaces, minimize impacts on the existing airfield geometry, and provide an optimal approach to Runway 16 and departure path off Runway 34. The study established the Runway 16/34 end points, length, and alignment used in the alternative analysis. Analysis results confirmed the geometry of Runway 16/34 is feasible without affecting Runway 02/20 geometry. The Preliminary Siting Study is included in **Appendix A**.

Runway 16 would be equipped with a Lateral Precision with Vertical Guidance (LPV) approach with 1-mile visibility minimums and 355 feet above airport elevation decision altitude. This means an appropriately equipped aircraft may approach the runway when restrictions such as clouds and fog or precipitation limit reported visibility to not less than 1 mile.

The **Decision Altitude** is the vertical height above the ground at which the aircraft may descend under those restricted visibility conditions before a decision to go around and utilize the missed approach procedures becomes required.

Figure 4-1: Runway Alternative Diagrams



Source: Mead & Hunt, Inc.

This design features a departure procedure for Runway 34 with a lower climb gradient than what is offered on Runway 02 today. This means the aircraft will need to climb vertically up 344 feet for each nautical mile over the ground it travels. More information on the proposed instrument procedures is provided in the Instrument Flight Procedure (IFP) Assessment Overview in **Appendix B**.

A goal of constructing Alternative 1 is to shift traffic from the existing runways to Runway 16/34. By constructing this runway, air traffic will arrive and depart in airspace directly north of TRK and over fewer residences and lower terrain. Evaluation of this alternative will determine if this results in less noise and overflight impacts to residences.

Alternative 2 – Runway 02/20 Extension and Widening (2015 AMP preferred)

Extending and widening Runway 02/20 is the preferred alternative from the 2015 AMP. Alternative 2 proposes to lengthen Runway 02/20 from 4,650 feet to 5,055 feet and widen it from 75 to 100 feet. This alternative is included on the TTAD and FAA-approved 2015 ALP.

The goal for construction of Alternative 2 is to entice more operations on this runway, especially by turboprops, and small- and medium-sized business jets. Extending beyond 5,000 feet opens this runway up for a larger class of aircraft that are currently operating on Runway 11/29, for example those with higher approach speeds or heavier aircraft. These aircraft are already operating at TRK, and lengthening/widening Runway 02/20 would not open up TRK to larger aircraft since Runway 11/29 would still be the longest runway.

Extending beyond 5,000 feet also enables existing turboprop and turbine aircraft users to evaluate this surface while conducting planning activities such as runway use calculations. Currently, runways of less than 5,000 feet are seldom considered in the arrival planning process, which drives utilization of 02/20 downward. Aircraft able to use Alternative 2 will vary based on operating manuals, company standard operating procedures, and weather conditions at time of operation.

Alternative 3 – Runway 11 Displaced Threshold

Alternative 3 shortens the landing threshold on Runway 11 by 1,000 feet. No other changes to Runway 29 or Runway 02/20 are proposed with this alternative. With declared distances, the length for arrivals and departures on Runway 29 does not change, nor does the departure length on Runway 11.

Implementing Alternate 3 serves two purposes: keeping aircraft landing on Runway 11 higher over residences west of TRK, and with the shorter available landing length, enticing aircraft to circle to land on Runway 29 when this operation is safe to perform.

Alternative 4 – Third Runway and Runway 11 Displaced Threshold

Alternative 4 combines Alternative 1 and Alternative 3.

No Build – Existing Conditions

The No Build scenario maintains the existing runway configuration at TRK. This scenario is included for analysis as a control scenario to compare with the four build alternatives.

Alternative Runway Utilization Estimates

The Runway Utilization Estimate Paper, **Appendix C**, summarizes the process by which operations are estimated on the different alternative runway scenarios for this Feasibility Study. This Paper summarizes pilot and operator interviews and describes methods for quantifying the shift in operations to each of the alternatives. These shifts in operations will be used as input for noise and overflight analysis.

PILOT AND OPERATOR INTERVIEWS

Pilots were asked about operations on existing runways, on conceptual Runway 16/34, on an extended Runway 02/20, and with a displaced threshold on Runway 11. Pilots interviewed consisted of local pilots based at TRK, transient pilots, and Part 91 and Part 135 operators. A full summary is provided in **Appendix C**, with the following recurring themes regarding existing conditions:

- Operator consensus indicated the preferred runway for arrivals and departures is Runway 29. The primary reason was this runway offers the longest length. Runway 11 was next, then Runway 20 for arrivals (when possible or winds dictate), and Runway 02 for departures under calm winds.
- Jets and some turboprops utilize the Runway 20 Instrument Approach Procedure (IAP) to access TRK, and then circle to land on Runway 29 if Runway 02/20 is too short for the specific aircraft operating specifications.
- During calm wind conditions (0-3 knots), operators overwhelmingly indicated that Runway 29 is the preferred runway for arrivals and departures.
- The operators indicated they will land on Runway 20 when winds favor this runway, and their aircraft is able to use the shorter runway.
- Pilots and operators indicated they are familiar with and follow noise abatement procedures.
- Pilots revealed they listen to Airport Traffic Control (ATC) for runway use when this is suggested during calm wind conditions and will use the suggested runway if the pilot finds it to be safe.

Pilots were asked about operating patterns and use on each alternative, and these are included with alternative analysis under airfield operations.

RUNWAY USE ESTIMATES

Information provided by pilots and ATC formed the basis for the development of the runway utilization estimates, supplemented with weather data, including wind data and density altitude. The numbers represent the maximum-use scenario and were vetted with TRK and ATC staff.

Operations for Alternatives

The Vector operations data set from June 1, 2020, to May 31, 2021, contains approximately 37,000 total operations available for this analysis. Of this, about 6,000 operations were either local or helicopter operations. The local operations may be either touch-and-go, training flights, or gliders. It was determined these operations would not likely move in a significant amount to any of the four alternatives, especially with Runway 16/34 proposed to be a contraflow runway. Also, glider operations may be affected with implementation of Runway 16/34, but this analysis assumes that this facility will be relocated, and operations will continue on Runway 02/20.

These factors resulted in a total of 31,084 operations determined as movable from an existing runway operation to another runway in each scenario. The same number of operations is used in each alternative (without local and helicopter operations) to provide a direct comparison for each runway alignment.

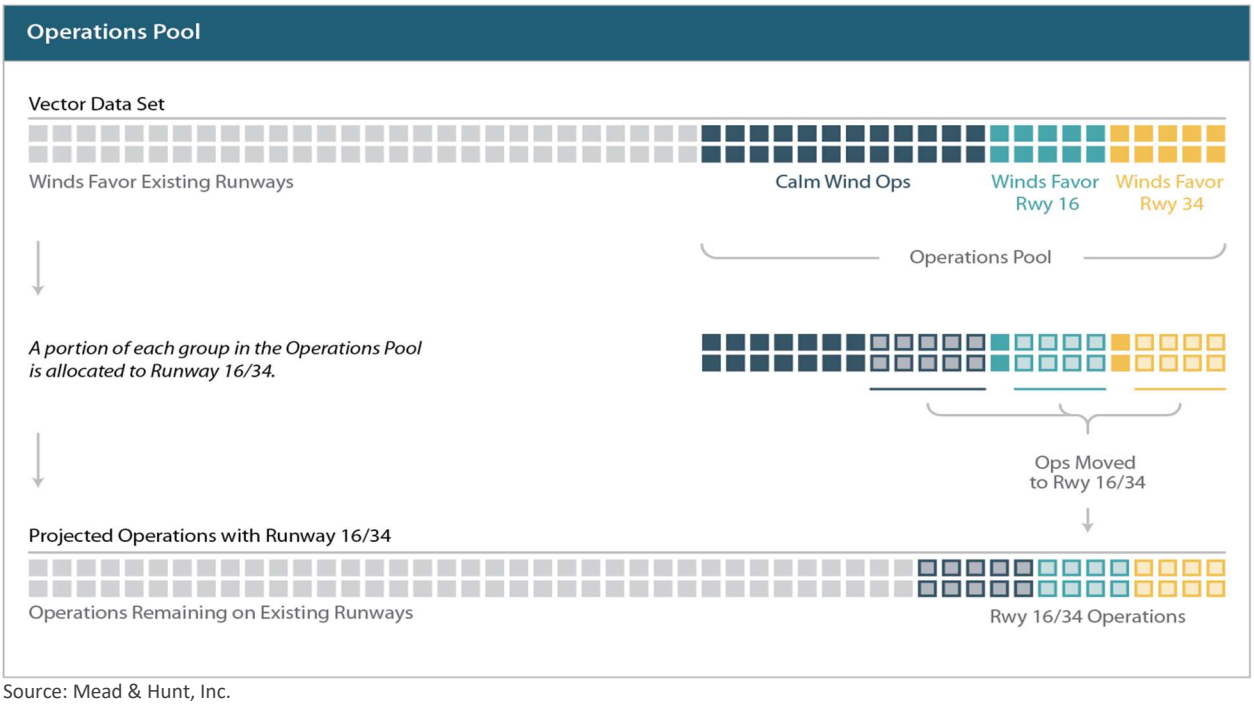
It is noted, particularly in Alternatives 1 and 4, that the introduction of an LPV approach could result in operations slightly increasing at TRK due to improved approach capabilities. This was discovered during pilot interviews and noted below in Airfield Operation impacts. However, to show a true comparison for any shifts in noise from moved aircraft operations, each alternative's operations pool for noise and overflight analysis is identical.

Vector Data Set

- Operations from June 1, 2020, to May 31, 2021
- A full year of operations with time, runway, and aircraft type.
- The data represents typical flow on the existing runways: there was no runway construction, were no major fires or smoke impacts, and operations had recovered to pre-2020 COVID-19 shutdown numbers.

The Vector operations data was then correlated with weather data over the same period. This correlation showed how many operations occur during various wind and weather conditions and pointed to when these conditions would favor operations on each alternative alignment. For each alternative, an operations pool created from the Vector data set helped quantify the number of operations that may be moved to each alternative for noise analysis. The operations pool represented scenarios when weather conditions favor that particular runway configuration. **Figure 4-2** graphically represents this methodology and represents a similar process for the other alternatives. **Appendix D** details the number of operations moved for each alternative scenario for noise analysis.

Figure 4-2: Operations Pool Scenario



Source: Mead & Hunt, Inc.
Note: Graphic is for information purposes only to illustrate the Operations Pool process and moving operations. Boxes are arbitrary and do not represent a specific number of operations for any alternative.

Noise Analysis

The Technical Noise Memo is presented in **Appendix E** and contains background on noise metrics used for analysis, graphics showing noise impacts, flight tracks, and general information on the noise modeling process. The FAA's Airport Environmental Design Tool (AEDT) Version 3e was used to prepare the noise analysis and contours to help evaluate runway alternatives.

NUMBER ABOVE ANALYSIS

The Number Above metric is used to evaluate overflight and noise impacts for each alternative. The Number Above analysis shows the number of aircraft events above a certain decibel (dB) level on an average annual day. This is accomplished by modeling the Vector data set and aircraft identification data on existing flight tracks. For each alternative, flight tracks are moved from the existing condition to the new runways to modifying that condition for each alternative. This process uses the same number of annual operations, as described in Operations for Alternatives above.

Discussion with TTAD Ad Hoc committee and TRK staff determined that the Number Above analysis using the 70 dB level (NA70) was appropriate for measuring average day events and comparison of alternatives to the No Build base case. Analysis used an annual average day to balance seasonal shifts in operation patterns. More information on NA70 analysis and graphics are shown in **Appendix E**.

Population and Housing Unit Counts

The NA70 analysis yields a graduated map with color bands that reflect a range of daily noise events above 70 dB on an average day at TRK. The graphic provides population and housing unit totals within each band. The results show a quantity of homes and people that experience overflight of aircraft that produce 70 dB events daily for each alternative. No other criteria being evaluated in this Study offers as strong of a qualitative metric as NA70 provides to evaluate the primary goals: to reduce noise, overflight, and annoyance.

2020 U.S. Census data was used to identify population for NA70 analysis. In order to estimate the number of people residing within the noise grid, 2020 US Census Block boundaries (which depict the smallest Census enumeration unit) were used in conjunction with residential land use. Residential Census data polygons were created by combining Census Blocks with the residential land use data. The residential polygons concentrated population and housing unit values into the residential land use portion of the census block. For example, the population is concentrated near roads within the residential polygons, rather than over several square miles of open or undeveloped land covered by the Census Block.

Then, using Geographic Information System (GIS) tools, the NA70 analysis grid cells were intersected with the residential polygons for each alternative to calculate the estimates for population and housing unit counts within each NA70 level. Greater detail regarding these overlapping methodologies can be found in **Appendix E.**

NA70 analysis in each alternative below shows discrepancies in impacts to residences and housing units, as little correlation exists between population and housing in the vicinity of TRK area. This is largely due

to the abundance of secondary homes and seasonal workers in the area, so the location of people does not necessarily correlate to housing locations. Also, Census data, while generally reliable, should be considered a guide rather than absolute data, especially in an area like Truckee with seasonal residents and secondary homeowners.

CNEL CONTOURS

Noise contours using the Community Noise Equivalent Level (CNEL) metric were also developed for each alternative. These are the California and FAA standards for measuring noise impacts. However, as is the case in the vicinity of TRK, most noise complaints come from persons residing outside CNEL 65 contours. Therefore, the NA70 metric was selected to supplement CNEL contours for this alternatives analysis. The CNEL contour graphics are shown in full in **Appendix E**.

Runway Alternatives Analysis

The Study established four alternatives that alter the runways and airfield composition, plus a no-build scenario. These runway alternative configurations will be evaluated on the criteria established to meet TTAD established goals, as presented in the Introduction.

Evaluation Criteria

The four main evaluation criteria, summarized in the following sections, consisted of airfield operations, off-airport impacts, environmental impacts, and rough order magnitude cost estimates.

Airfield Operations

Airfield operations analysis addresses physical changes required, design requirements, operations and movement, and facilities altered for each alternative that affect the airfield. Runway Taxiway Geometry Impacts

- Runway / Taxiway Geometry
- FAA Compliance
- Runway Utilization / Aircraft Movement
- Effects on Support Facilities
- NAVAIDs and Instrument Approach Capabilities

This also summarizes impacts from instrument procedures developed for each alternative, which are described in more detail in **Appendix B.** See **Appendix C** for pilot and ATC comments on runway use and operations for each alternative.

Off-Airport Impacts

The Off-Airport impacts section summarizes noise and overflight of residences and how these change for each alternative. This includes planned residential developments in the vicinity of TRK.

- Noise Impacts
- Residential Overflight
- Future Land Use Considerations

The full Technical Noise Memo is provided in **Appendix E**, and Future Land Use Developments are presented in **Appendix F**.

Environmental Impacts

Environmental impacts with likely mitigation with the appropriate environmental document are summarized for each alternative.

- Primary Environmental Considerations
- Sustainability Considerations
- Anticipated Level of Environmental Review for both NEPA and the California Environmental Quality Act (CEQA)

The full Environmental Screening Report is provided in **Appendix G**. The screening criteria match the standard NEPA checklist.

Rough Order Magnitude Cost Estimates

Rough Order Magnitude (ROM) cost estimates were developed, and a cost range is provided for each alternative. ROM cost estimates should be viewed as comparative to the other alternatives as opposed to refined estimates. While ROM estimates use best available data and prices, these are planning level estimates and assumptions on variables were made, particularly on earthwork and fill estimates.

- Constructability
- Maintenance
- FAA Support

More information on ROM cost estimates is provided in **Appendix H.**

Runway Design Standards

For each alternative, runway design standards are shown based on the anticipated Runway Design Code (RDC). This is determined by the aircraft fleet mix, critical aircraft, and wind coverage. This is described in more detail in **Facility Requirements**.

Runway 11/29 is shown as a C-II RDC runway. This reflects the requirement of upgrading this runway to meet standards for the critical aircraft for FAA compliance and the associated projects (increase in the size of the Runway Protection Zone (RPZ) and Runway Safety Area (RSA), and realignment of the Taxiway A centerline from 250 feet to 300 feet from the Runway 11/29 centerline).

With the exception of Alternative 2, Runway 02/20 is shown in all alternatives as a B-I RDC runway. This matches the eligibility requirements found in Facility Requirements, as this runway would likely not qualify as a crosswind runway based on wind coverage. To meet the goal of Alternative 2, Runway 02/20 is shown designed to B-II RDC standards and beyond (100-foot-wide runway) to facilitate and protect for operations by larger aircraft. Taxiway G is also realigned to be 240 feet from Runway 02/20 (taxiway centerline to runway centerline). TTAD may need to cover the costs for runway and taxiway design to beyond B-I standards.

Runway 16/34 is shown as an RDC B-II runway. This design will help this runway accommodate turboprops and jet aircraft at maximum runway length while providing standard RSA and Runway Object Free Area (ROFA) on TRK property. The RDC B-II runway width standard is 75 feet; however, a ROM cost option is provided for 100 feet.

Ultimately this Study is intended to show how a shift in operations will meet goals and objectives. The RDC of each runway will not likely affect or shift operations. Other facility requirements deemed not consequential to this Runway Feasibility Study include the facilities listed below. Each may be reevaluated as part of Phase 2 of the Master Plan with the preferred alternative design and integrated into the ALP.

- Realigning Taxiway A from 250 feet to 300 feet from the Runway 11/29 centerline to conform to C-II RDC separation standards (not shown on alternative graphics)
- Increasing the RSA and RPZ dimensions and impacts (shown on alternative graphics)
- Realigning Taxiway G from 180 feet to 225 feet from Runway 02/20 centerline to conform to B-I RDC separation standards (not shown on alternative graphics).

Runway Design Terms and Definitions

Critical Aircraft is the most demanding aircraft type that make regular use (500 annual operations) of an airport. The critical aircraft determines the applicable design standards for facilities on the airport including individual runways, taxiways, etc.

Runway Design Code (RDC) is a coding system used signifying the critical standards that apply to an existing or planned runway, based on the Critical Aircraft using a runway.

Runway Safety Area (RSA) is a defined area surrounding the runway consisting of a prepared surface suitable for reducing the risk of damage to aircraft in the event of an undershoot, overshoot, or excursion from the runway.

Runway Protection Zone (RPZ) is an area at ground level prior to the threshold or beyond the runway end to enhance the safety and protection of people and property on the ground.

Runway Object Free Area (ROFA) is an area centered on the surface of a runway to enhance the safety of aircraft operations by remaining clear of objects, except for objects that need to be located in the ROFA for air navigation or aircraft ground maneuvering purposes.

Declared Distances are distances declared available for an aircraft's takeoff run, takeoff distance, accelerate-stop distance, and landing distance requirements.

Source: FAA Advisory Circular-150/5300-13B

ALTERNATIVE 1: THIRD RUNWAY (RUNWAY 16/34)

Alternative 1 proposes to meet the goals of the feasibility study by constructing a new runway, Runway 16/34. The new runway would be 5,900 feet long, 75 feet wide and located on existing TRK property. To maintain standard RSAs, the threshold for Runway 29 shifts 485 feet to the west. Consequently, declared distances are proposed on Runway 11/29 to maximize operational length. Runway 16/34 would be designed to B-II RDC standards to accommodate the majority of aircraft using TRK today. Runway 16 will be equipped with an IAP with 1-mile visibility minimums, and Runway 34 will be visual. Runway 34 will have a displaced threshold of approximately 3,550 feet and would primarily be a contraflow use runway with arrivals from and departures to the north. **Figure 4-3** shows Alternative 1 geometry with design standards and impacts to existing facilities.

Contraflow Runway is runway that is primarily used in one direction, with arrivals and departures occurring in opposite directions. Contraflow runways are usually seen in narrow valleys or where terrain blocks one end from having a clear approach and departure path. Contraflow runways are sometimes referred to as muzzleloader runways.

Alternative 1 Airfield Operations

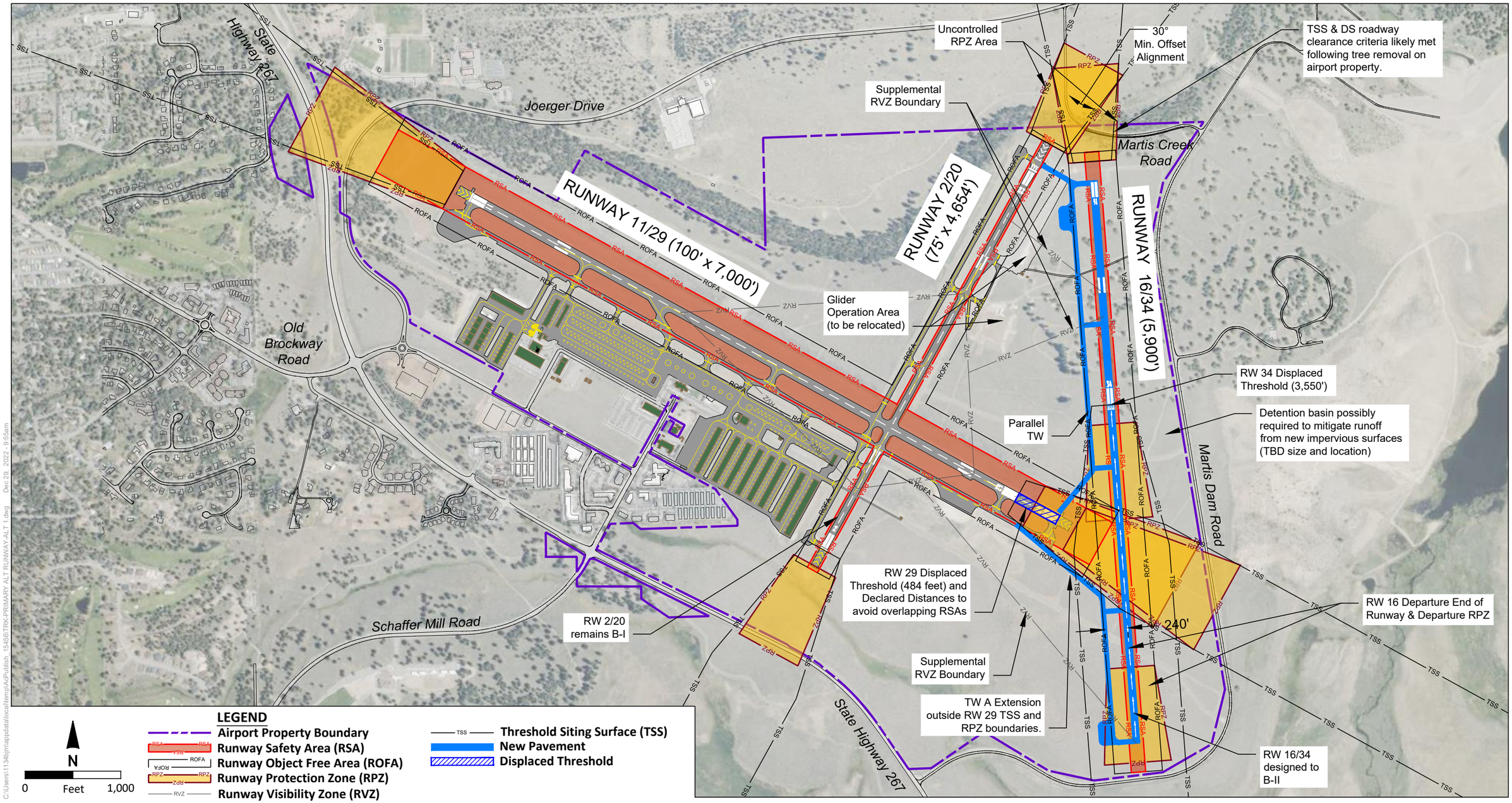
The effects of Alternative 1 on airfield operations are listed below, with the primary benefits being the potential shift of operations on existing runways to Runway 16/34, and the implementation of an LPV approach to Runway 16. Runway 16/34 will be a contraflow use runway under most circumstances.

Runway / Taxiway Geometry Impacts

- Runway 11/29 length will be reduced slightly for some operations, due to implementation of declared distances to avoid overlapping RSAs.
- Taxiway A will be extended to the south end of Runway 16/34.
- Aircraft will be required to cross the Runway 20 approach to access the north end of Runway 16/34.

TRUCKEE TAHOE AIRPORT

Figure 4-3: Alternative 1 - Third Runway (Runway 16/34)



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Third Runway 16/34

Truckee Tahoe Airport

FAA Compliance

- Runway 16/34 is designed as an RDC B-II runway at maximum runway length while providing the standard RSA and ROFA on TRK property.
- Runway 02/20 is proposed to be designed to meet B-I standards (Facility Requirement recommendation) to shift resources to Runway 16/34.
- Declared distances will be implemented on Runway 11/29 to maintain design standards and prevent overlapping RSAs.
- The new intersection runways will require supplemental runway visual zone (RVZ) areas which classify areas to be cleared for line-of-sight standards between runways.

Runway Utilization / Aircraft Movement

- Operations would shift to Runway 16/34, decrease operations on Runways 11/29 and 02/20.
- Operations would primarily be to/from the north, with arrivals on Runway 16 and departures on Runway 34.
- Aircraft taxi lengths will increase to access Runway 16/34.
- Pilots expressed interest in Runway 16/34, and the LPV approach may encourage operations.
- Other pilots stated a continuing preference for Runway 11/29, due to length, lack of access (taxiing time from the terminal area), and lack of facilities near Runway 16/34.
- Some operators indicated an LPV approach may result in more operations.
- ATC staff noted that Runway 16/34 may not be efficient, especially during peak operation times. (See **Appendix C** for all pilot and ATC comments)

Effects on Support Facilities

- Glider and skydiving facilities will need to be relocated to maintain RVZ clearance standards.
- Pavement area will increase, which may require greater areas for snow removal and maintenance.
- Runway 16/34 will increase airfield lighting and other utility needs.

NAVAIDs and Instrument Approach Capabilities

- The Runway 16 LPV approach will offer the best decision altitude and vertical guidance at TRK.
  - The LPV approach offers a continues descent approach opposed to a step-down approach. The continuous descent results in less noise impacts compared to the step-down approach.
- The Runway 34 departure procedure will offer the lowest climb gradient at TRK.

Alternative 1 Off-Airport Impacts

Alternative 1 off-airport impacts include decreasing NA70 events on both population and housing units.

Noise Impacts

Figure 4-4 illustrates the NA70 comparison for Alternative 1 with the No Build (Existing) scenario, with callouts highlighting significant changes in NA70 events. The figure shows a shift in NA70 events, moving from the areas northwest of TRK primarily to areas north of the Airport. These impacts reflect the shift in operations from the existing runways to Runway 16/34.

NA70 events are reduced northwest of Runway 11 near the Alder Hill Neighborhoods, Pine Forest/Coachland, and Martis Creek Estates. Olympic Heights, and Royal Way in Glenshire also see reduced noise with more use of Runway 16/34.

There are areas with a significant decrease in noise events with Alternative 1. Areas of Alder Hill move from 5-10 events (Green) to 2-5 events (Blue). Olympic Heights, Martis Creek Estates, and Pine Forest/Coachland move from areas of 20-50 events (Orange) to 10-20 events (Yellow), or from 10-20 events (Yellow) to 5-10 events (Green).

NA70 events increase over the I-80 scales, Airport Flats, and Tinkers Landing / Dove Terr Road / Gray's Crossing Area. Most area increases on residences are moving from the None to 1-2 events (Purple), or from 1-2 to 2-5 events (Blue).

NA70 Event Comparison Graphics

NA70 event comparison graphics (**Figures 4-4, 4-6, 4-8, 4-10**) illustrate the difference in NA70 event color bands for each alternative, from operations on the existing runway configuration.

The **White Dashed Areas** are highlighted to help the reader view and compare areas where there are significant changes to NA70 events.

Populated Grid Points are red and green dots that help show where NA70 events increased or decreased over population and/or housing units. These points represent noise analysis grid cells and do not quantify or represent population or housing unit counts. See **Appendix E** for more information on the data grid.

Residential Overflight

Table 4-1 presents the estimated count of population and housing units within each NA70 event color band for Alternative 1, and the change from existing.

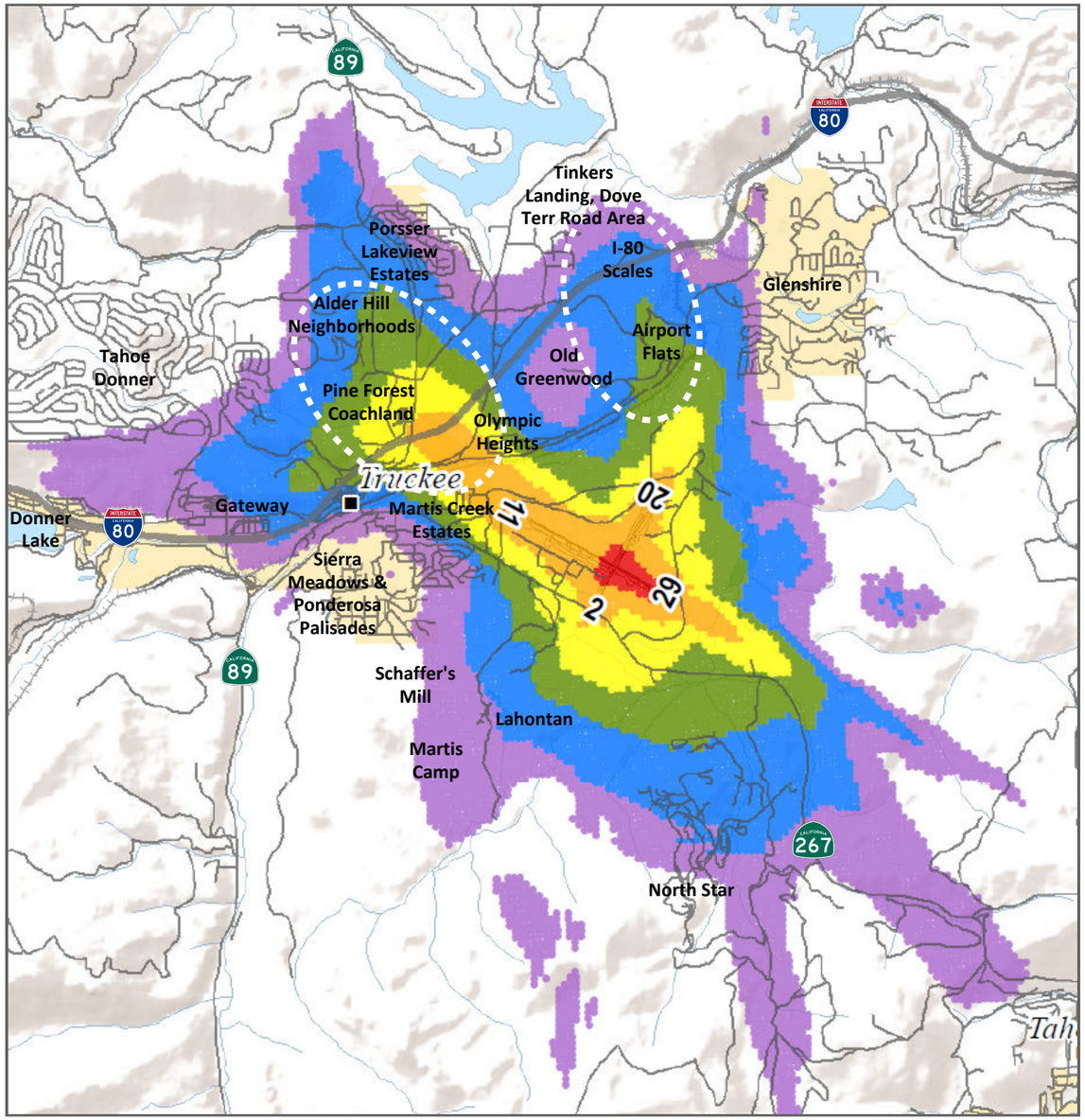
Table 4-1: Alternative 1 Population, Housing Units, and Area with Noise Above 70 dB Events

Number Above 70 dB Events	Population	Change from Existing	Housing Units	Change from Existing	Total Area (Sq. Miles)	Change from Existing
1-2	3,815	+39	3,441	+143	11.1	-2.5
2-5	2,425	-287	2,275	-475	9.6	-0.8
5-10	978	+127	531	-104	4.9	-0.2
10-20	1,196	-126	471	-49	3.6	+0.4
20-50	87	-127	39	-51	2.2	+0.1
Aggregate	8,501	**-374**	6,757	**-536**	31.3	**-3.0**

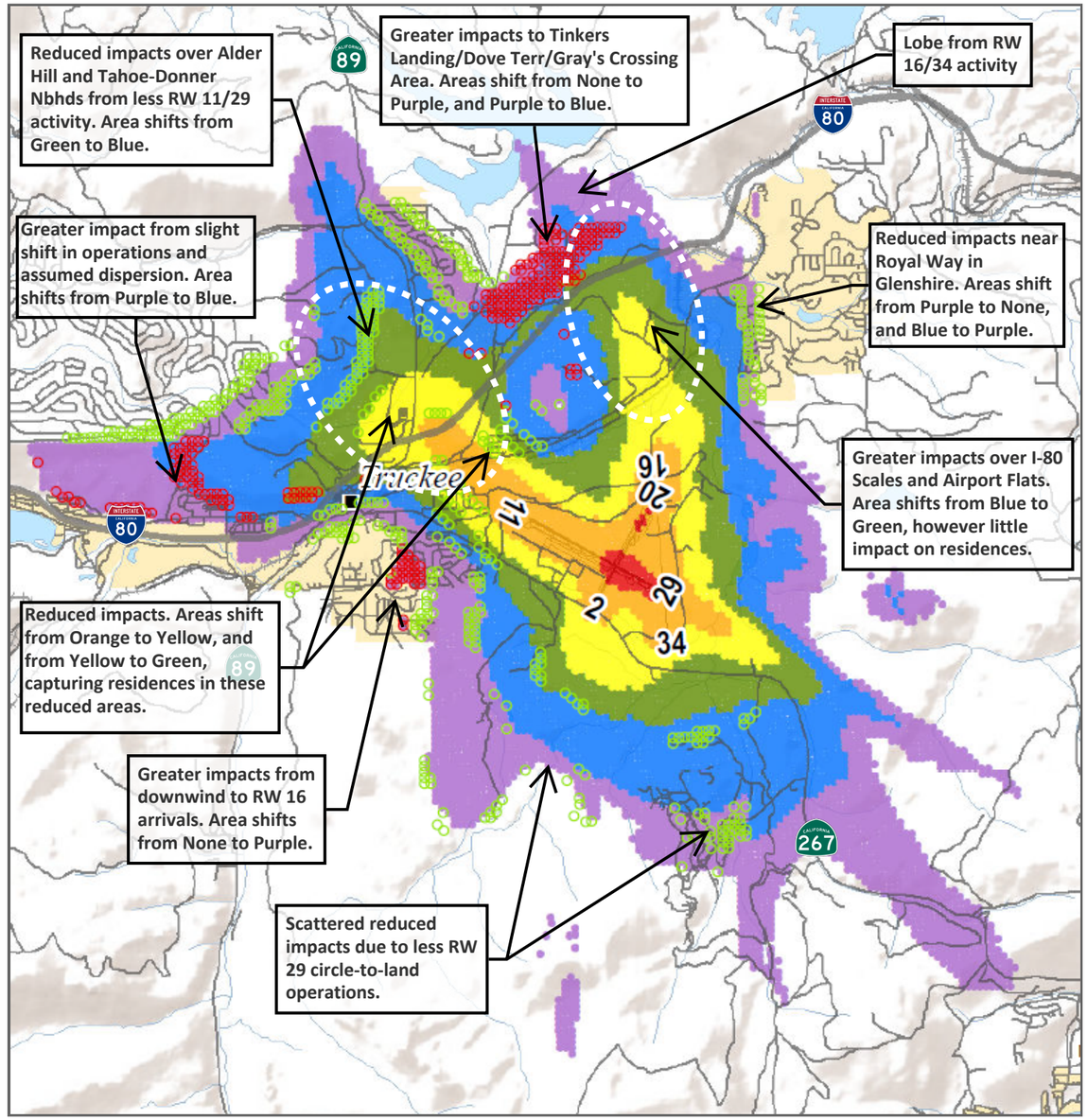
Source: HMMH and Mead & Hunt
Figures represent NA70 events in each individual color band.
Note: All greater than 50 NA70 dB events are located on TRK property.

Figure 4-4: NA 70 Comparison: No Build and Alternative 1

No Build - Existing Conditions



Alternative 1 - Third Runway (Runway 16/34)



Source: HMMH and Mead & Hunt
Service Layer Credits: Esri, USGS, NOAA

N

0 Feet 10,000

LEGEND

Areas with Number of Events Above 70 dB
- 1-2
- 2-5
- 5-10
- 10-20
- 20-50
- > 50 Events

- Populated Grid with a Decrease in N70 From Existing[1]
- Populated Grid with an Increase in N70 From Existing[1]
- Roads
- Urban Area
- Railroad
- Water / Stream

Notes:
Results are based on operations that represent an average annual day.

1. Populated Grid Points illustrate noise grid cells where NA70 events increased or decreased over population and/or housing units with each alternative. These points do not quantify or represent population or housing unit counts. See Noise Analysis section in the Runway Feasibility Study and Appendix E for more information on the data grid.

Table 4-1 above shows a mix of population areas and housing units that both increase and decrease with NA70 impacts. On the aggregate, both population and housing units experience a decrease in noise events. The Green 5-10 event band is increasing events on population. This is likely a product of shifting noise events and having these population areas moving out of the Yellow 10-20 and Orange 20-50 events bands. The same is true for the Purple 1-2 event band, as this shows increases in population and housing units, mostly from a shift from the Blue 2-5 event band.

As explained previously, little correlation exists between housing units and population due to seasonal and secondary homeowners, so some event bands (Green 5-10) show a decrease in NA70 events on housing units and an increase in NA70 events on population.

Future Land Use Considerations

Future land use developments were considered in this evaluation; analysis indicated Alternative 1's impact on each site to be negligible. Descriptions of each site reviewed can be found in **Appendix F**. Alternative 1 will require an update of the Airport Land Use Compatibility Plan (ALUCP) to include Runway 16/34.

Alternative 1 Environmental Impacts

Full environmental screening criteria for Alternative 1 is reviewed in **Appendix G**, with relevant categories, sustainability impacts, and likely required environmental process listed below.

Primary Environmental Considerations

- Shifts areas of noise exposure due to new Runway 16/34 orientation and approach and departure routes (explained in Off-Airport Impacts).
- Possible wetland impacts in project area due to the undetermined borders of National Wetlands Inventory wetland in the vicinity of parallel taxiway.
- Possible water quality impacts due to fill in existing low area and increased amount of impervious surface.
  - Project required to direct drainage away from new impervious surface and into the existing stormwater management system.
  - Cultural survey would be needed due to new ground disturbance.
  - Any resources found would require an effect determination and eligibility evaluation.
- Potential for the presence of species requiring state review in unsurveyed area.
- Potential for Department of Transportation Section 4(f) impacts to Alpine Meadow Campground and nearby trails should be evaluated.

Sustainability Considerations

- Runway 16/34 would offer a more efficient approach that may reduce fuel burn time for approaching aircraft from current procedures.

- Runway 16/34 would require extra taxiing distance and time resulting in greater aircraft and vehicle travel times and greater fossil fuel burn.
- Runway 16/34 would require more vehicle miles from maintenance and snow removal.
- Runway 16/34 may impact drainage areas that affect overall stormwater runoff on the Airport during rain or snow events, influencing the resilience of the airfield.
- All new construction materials/pavement correspond to emissions generated in their production.

Anticipated Level of Environmental Review

- Federal (NEPA): Environmental Assessment
- State (CEQA): Environmental Impact Report

Alternative 1 ROM Cost Estimates

The ROM Cost Estimates for Alternative 1 range from $40 to $48 million. This ROM estimate includes construction, design, environmental, and contingency for Runway 16/34 and associated taxiways. Cost estimates were prepared for construction of a 75-foot-wide runway ($40 to $45 million) and a 100-foot-wide runway ($43 to $48 million).

Constructability

- Runway 16/34 may present challenges to constructability that include drainage and increasing impervious surfaces.
- Depending on construction time market conditions, supply chain challenges and labor shortages may also increase complexity and costs.

Maintenance

- Pavement monitoring and periodic rehabilitation will increase with Runway 16/34.
- Utilities and maintenance staff hours will increase to perform regular maintenance on this runway.
- Staff hours will increase to clear Runway 16/34 during a snow event.

FAA Support

- Due to existing wind coverage on Runway 11/29 and 02/20, Runway 16/34 will likely not attain *Airport Improvement Program (AIP) Handbook* status as a primary, secondary, or crosswind runway, and is therefore ineligible for FAA support.

There may be opportunity for Runway 16/34 to be classified as the crosswind runway if Runway 02/20 is decommissioned. However, decommissioning Runway 02/20 would require FAA support and likely require repayment of grant funding for Runway 02/20 and facilities associated with this runway over the past 20 years. Decommissioning Runway 02/20 is not recommended as part of this Study.

ALTERNATIVE 2: RUNWAY 02/20 EXTENSION AND WIDENING

Alternative 2 proposes to meet the goals of the feasibility study by lengthening Runway 02/20 from 4,650 to 5,055 feet and widen this from 75 to 100 feet. The lengthening and widening are proposed to support and attract more operations to this runway. Alternative 2 is the preferred alternative from the 2015 AMP. **Figure 4-5** shows Alternative 2 geometry with design standards and impacts to existing facilities. This also illustrates the realignment of Taxiway G to meet B-II standards. However, this would be a separate project and designs for this alignment and separations may be further considered if Alternative 2 is preferred.

Alternative 2 Airfield Operations

The potential effects of Alternative 2 on airfield operations are listed below, with the perceived benefit being the potential shift of operations from existing runways to Runway 02/20.

Runway / Taxiway Geometry Impacts

- No major impacts to existing facilities with runway shift to the south.

FAA Compliance

- Runway 02/20 proposed to be designed to B-II standards to help attract aircraft to this runway to meet goal of shifting operations from Runway 11/29.
- A displaced threshold of 535 feet is included for arrivals on Runway 02 and declared distances incorporated to maximize useable length while maintaining RSA and RPZ on TRK property and off Highway 267. Does not affect useable pavement for operations to and from the north.

Runway Utilization / Aircraft Movement

- Operations are estimated to increase on Runway 02/20 with more useable length and decrease on Runway 11/29, as revealed in pilot interviews. (See **Appendix C** for all pilot and ATC comments)
- The majority of operators indicated lengthening Runway 02/20 beyond 5,000 feet opens this runway up to larger cabin classes that currently only use Runway 29 for arrivals and departures.
  - Repeatedly, comments indicated Alternative 2 will make Runway 02/20 more available for turbine operations and will increase turboprop operations on this runway.
- However, a couple of operators indicated that lengthening Runway 02/20 will not shift their operations to this runway.
- ATC indicated that this extension may not result in a significant shift in operations to Runway 02/20, and charter operating procedures will dictate if aircraft use this alternative.

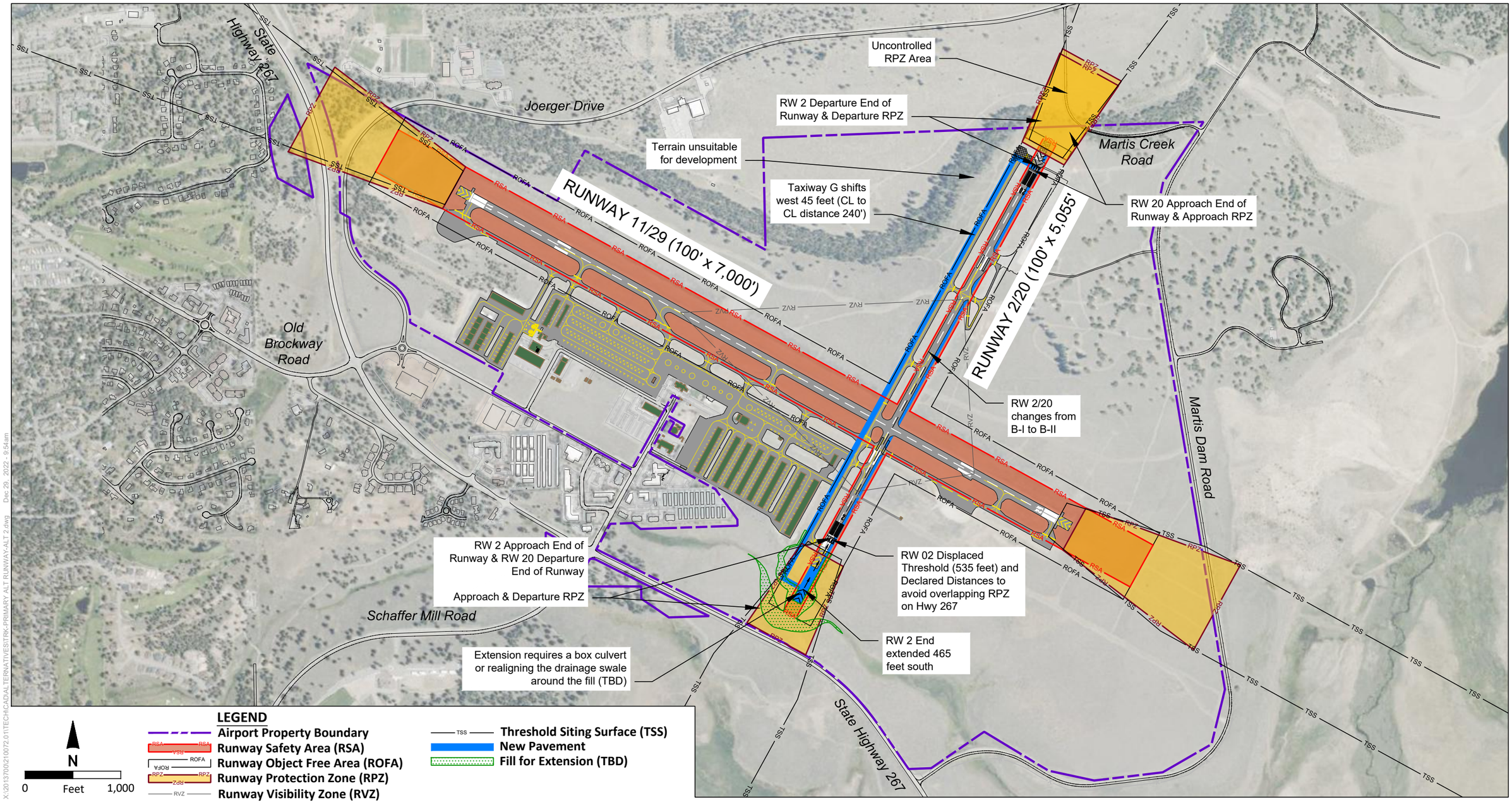
Effects on Support Facilities

- Glider and skydiving facilities may be affected with greater use of Runway 02/20, however relocation of facilities is not required.
- Pavement area will increase slightly with Runway 02/20 extension and widening.

NAVAIDs and Instrument Approach Capabilities

- The existing IAPs to Runway 20 (GPS-guided LNAV and the Localizer Performance) would be redesigned and implemented due to the relocation of the physical location of the Runway 20 end (with trivial changes to the IAP design surface).

Figure 4-5: Alternative 2 - Runway 02/20 Extension and Widening



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Runway 2/20 Extension and Widening

Truckee Tahoe Airport

Alternative 2 Off-Airport Impacts

Alternative 2 off-airport impacts include decreasing NA 70 events on both population and housing units.

Noise Impacts

Figure 4-6 illustrates the NA 70 comparison for the No Build scenario with Alternative 2, with callouts highlighting significant changes in NA 70 events. The figure shows a shift in NA70 events, moving from the areas northwest of TRK, primarily to areas north of the Airport and Runway 20.

NA70 events are reduced northwest of Runway 11 near the Alder Hill Neighborhoods, Pine Forest/Coachland. Olympic Heights, and Martis Creek Estates with more use of Runway 02/20.

Areas with a significant decrease in noise events include Olympic Heights, Martis Creek Estates, and Pine Forest/Coachland. These neighborhoods move from areas of 20-50 events (Orange) to 10-20 events (Yellow) or from 10-20 events (Yellow) to 5-10 events (Green). Areas of Alder Hill move from 5-10 events (Green) to 2-5 events (Blue).

NA70 events increase over the I-80 scales, Tinkers Landing / Dove Terr Road / Gray's Crossing Area, Airport Flats, and Royal Way in Glenshire. Lahontan and Martis Camp may also see some additional impacts. Most NA70 event increases in these neighborhoods are moving from the None to 1-2 events (Purple), or from 1-2 to 2-5 events (Blue).

Residential Overflight

Table 4-2 presents the estimated count of population and housing units within each NA70 event color band for Alternative 2, and the change from existing.

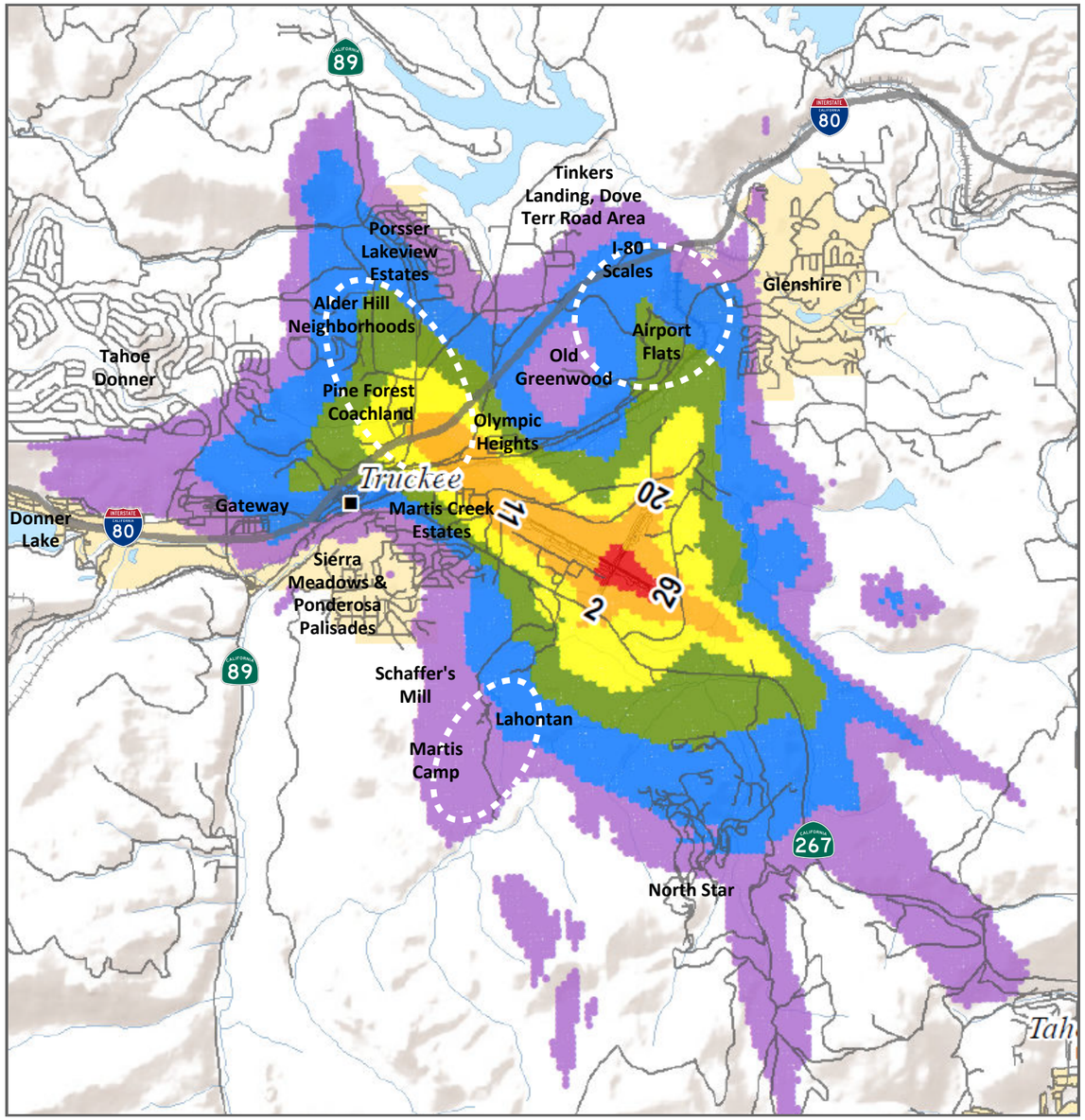
Table 4-2: Alternative 2 Population, Housing Units, and Area with Noise Above 70 dB Events

Number Above 70 dB Events	Population	Change from Existing	Housing Units	Change from Existing	Total Area (Sq. Miles)	Change from Existing
1-2	3,618	-158	3,306	8	13.7	0.1
2-5	2,790	78	2,693	-57	11.0	0.6
5-10	1,059	208	659	24	5.1	0.0
10-20	1,152	-170	452	-68	3.5	0.3
20-50	65	-149	30	-60	1.9	-0.2
Aggregate	8,684	**-191**	7,140	**-153**	35.1	**+0.8**

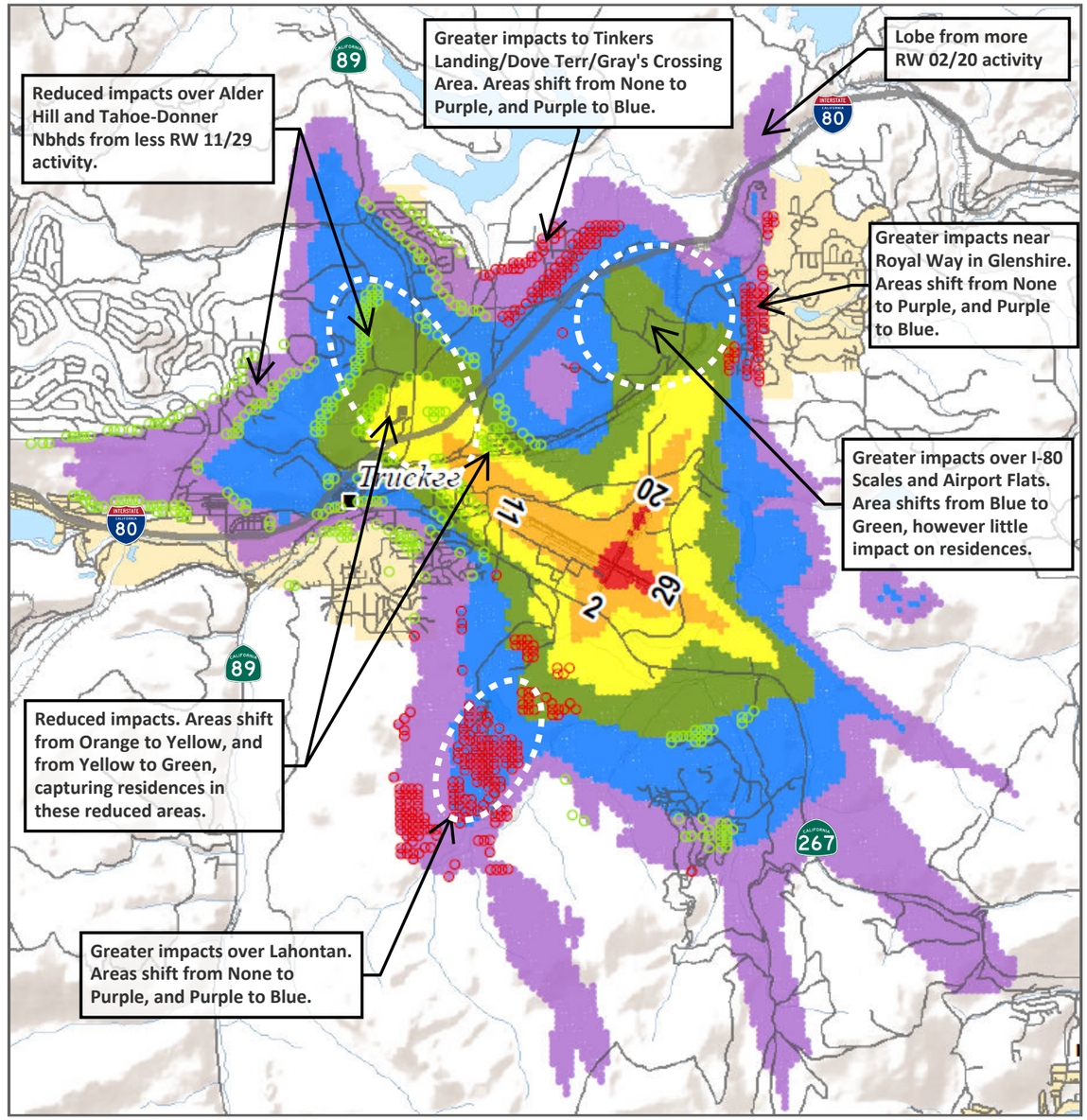
Source: HMMH and Mead & Hunt
Figures represent NA70 events in each individual color band.
Note: All greater than 50 NA70 dB events are located on TRK property.

Figure 4-6: NA 70 Comparison: No Build and Alternative 2

No Build - Existing Conditions



Alternative 2 - Runway 02/20 Extension and Widening



Source: HMMH and Mead & Hunt
Service Layer Credits: Esri, USGS, NOAA

N

0 Feet 10,000

LEGEND

Areas with Number of Events Above 70 dB
- 1-2
- 2-5
- 5-10
- 10-20
- 20-50
- > 50 Events

- Populated Grid with a Decrease in N70 From Existing[1]
- Populated Grid with an Increase in N70 From Existing[1]
- Roads
- Urban Area
- Railroad
- Water / Stream

Notes:
Results are based on operations that represent an average annual day.

1. Populated Grid Points illustrate noise grid cells where NA70 events increased or decreased over population and/or housing units with each alternative. These points do not quantify or represent population or housing unit counts. See Noise Analysis section in the Runway Feasibility Study and Appendix E for more information on the data grid.

Table 4-2 above shows a mix of population areas and housing units that both increase and decrease with NA70 impacts. On the aggregate, both population and housing units experience a decrease in noise events. Some color event bands show an increase in events. The Blue 2-5 and Green 5-10 event bands are increasing events on population. This is likely a result of shifting noise events and having these population and housing units moving out of higher color bands (Yellow 10-20 or Orange 20-50) and into the lower impact color bands.

As explained previously, little correlation exists between housing units and population due to seasonal and secondary homeowners, so some event bands (Blue 2-5) show a decrease in NA70 events on housing units and an increase in NA70 events on population.

Future Land Use Considerations

Future land use developments were considered as part of this evaluation; analysis indicated Alternative 2's impact on each site to be negligible. Descriptions of each site reviewed can be found in **Appendix F**.

Alternative 2 Environmental Impacts

Full environmental screening criteria are presented in **Appendix G** and anticipates that Alternative 2 will less impacts than Alternative 1. However, screening criteria revealed there may be possible wetland and cultural impacts.

Primary Environmental Concerns

- Likely wetland impacts and associated mitigation due to the direct impacts to the temporary stream beyond existing Runway 2 end.
  - Likely jurisdictional due to connection with Martis Creek Lake downstream.
- Possible cultural impacts:
  - Potentially eligible resources beyond either side of Runway 2 approach end, likely to be directly impacted by the project.
  - Potentially eligible resources north of Runway 20 approach end may be impacted by the project.
  - Further survey and eligibility determination needed.
- Possible mitigation:
  - Stream impacts: Further study would determine type and extent of effort required based on stream type and quality.
  - Cultural resource impacts: Further documentation of affected resources may be necessary, based on eligibility determination and final project disturbance limits.

Sustainability Considerations

- Construction would largely take place within existing disturbance area, using existing facilities.
- Slight increase to taxi distance and snow removal areas, but not substantial.

- Impacts to water resources and corresponding mitigation would affect natural environment at the airport and could influence overall drainage and stormwater. Depending upon the nature of the mitigation, the project could maintain the quality and function of the resource.

Anticipated Level of Environmental Review

- Federal (NEPA):
  - If wetland impacts could be covered under a nationwide permit, and if there are no adverse effects to cultural resources protected under the NHPA/4(f), then possible documented Categorical Exclusion.
  - If wetland impacts require an individual permit, or if adverse effects to cultural resources are anticipated, then possible full Environmental Assessment.
- State (CEQA): Mitigated Negative Declaration

Alternative 2 ROM Cost Estimates

The ROM Cost Estimates for Alternative 2 range from $15 to $19 million. This ROM estimate includes construction, design, environmental, and contingency. This ROM cost estimate does not include realigning parallel Taxiway G (to 240 feet centerline separation). The ROM cost estimate for this project ranges from an additional $9 to an additional $12 million.

Constructability

- Extending the runway to the south with fill and negotiating the drainage creek.
- Taxiway G will likely be a separate project but is shown as part of this Alternative to conform to B-II design.

Maintenance

- Alternative 2 would not significantly impact or require greater maintenance or require more staff hours to clear in a snow event.

FAA Support

As discussed in Facility Requirements, with wind coverage on Runway 11/29 over 95 percent coverage for ADG (Airplane Design Group) II aircraft, Runway 02/20 will only be eligible as a crosswind runway with FAA funding to ADG I standards. This equals funding for a runway that is 60 feet in width.

- Since data previously showed wind coverage supporting Runway 02/20 as an ADG II runway, winds should be analyzed on a regular basis (during future ALP updates and master plans) to determine if Runway 11/29 falls back below 95 percent coverage thereby making Runway 02/20 eligible for RDC B-II design funding, at 75 feet in width.

ALTERNATIVE 3: RUNWAY 11 DISPLACED THRESHOLD

Alternative 3 proposes to meet the goals of the feasibility study by displacing the Runway 11 landing threshold by 1,000 feet. With declared distances, the length for arrivals and departures on Runway 29 does not change, nor does the departure length on Runway 11. No other changes to Runway 29 or Runway 02/20 are proposed with this alternative. **Figure 4-7** shows Alternative 3 geometry with design standards and impacts to existing facilities.

Alternative 3 Airfield Operations

The effects of Alternative 3 on airfield operations are listed below, with the apparent benefits of shifting operations to circle to land on Runway 29 or having aircraft on approach to Runway 11 being higher over residences northwest of the Airport.

Runway / Taxiway Geometry Impacts

- Runway 11 landing threshold would be displaced 1,000 feet.
- Runway 11/29 would be designed with declared distances to maintain maximum usable pavement length while incorporating the displaced threshold on Runway 11.

FAA Compliance

- Runway 11/29 proposed to be designed to meet RDC C-II standards and Runway 02/20 designed to RDC B-I standards.

Runway Utilization / Aircraft Movement

- Arrivals by larger corporate jet aircraft may decrease on Runway 11 with the shorter landing distance, and result in these aircraft circling to land on Runway 29.
- The displaced threshold will not have a significant impact on the airfield for taxiway movement.
- No operator interviewed was in favor of Alternative 3.
- Operators believed the reduced landing length on Runway 11 decreases safety margin which may increase potential for overruns, or will result in more circle to land operations to Runway 29. (See **Appendix C** for all pilot and ATC comments).

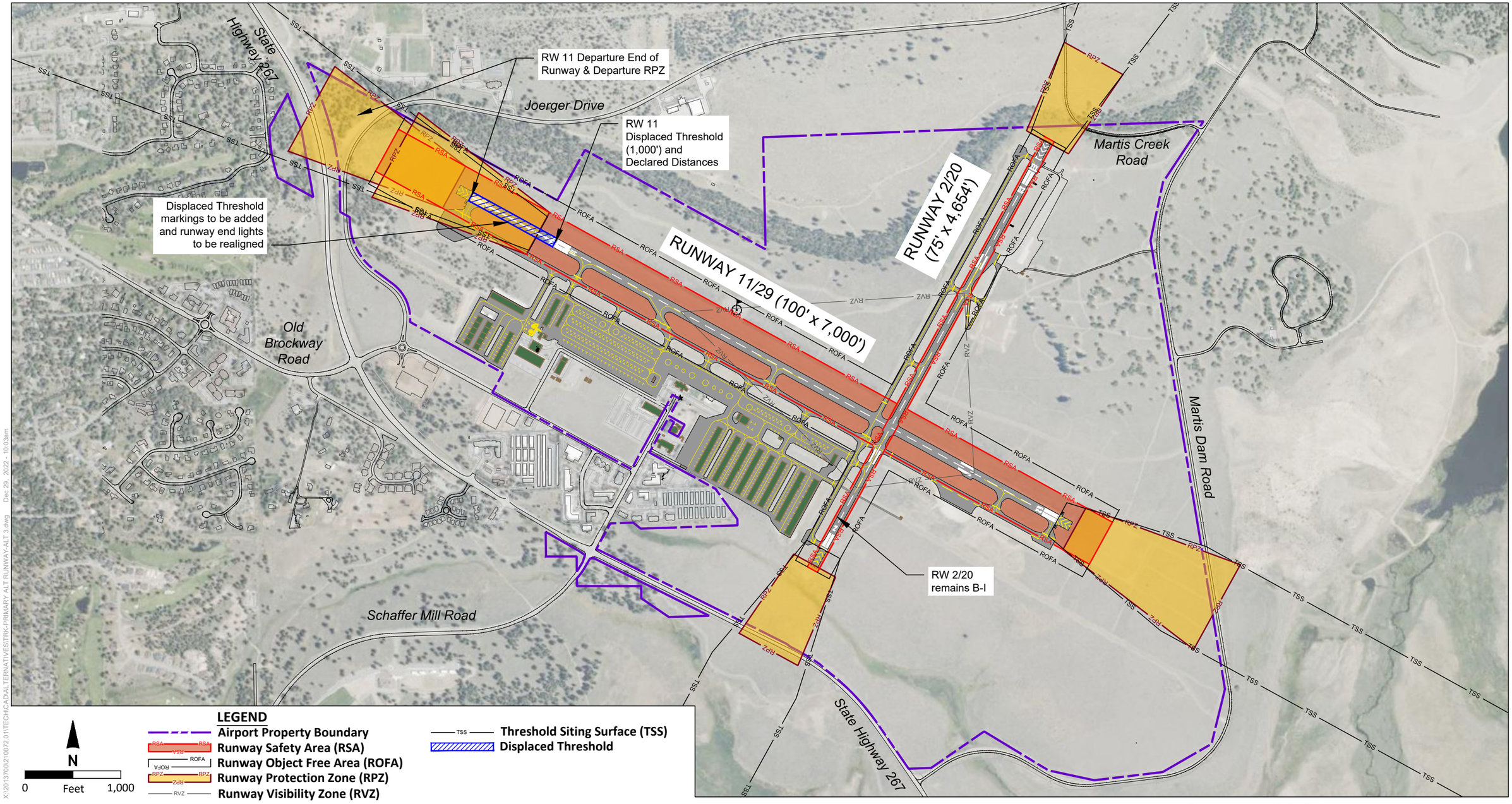
Effects on Support Facilities

- Runway lighting and marking will need to be reconfigured to the relocated threshold.

NAVAIDs and Instrument Approach Capabilities

- Minimal benefits to the IAP are realized by displacing the runway threshold due to surrounding terrain.
- A vertical descent path requiring a glide path angle of 4.14-4.51 degrees limits the approach to aircraft operating within approach category A or B approach speeds.
- Connection of the intermediate segment to the final approach segment could be accomplished as a circling approach using lateral-only guidance.
  - A straight-in line of minima could not be designed due to excessive descent angles.

Figure 4-7: Alternative 3 - Runway 11 Displaced Threshold



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Runway 11 Displaced Threshold

Truckee Tahoe Airport

Alternative 3 Off-Airport Impacts

Alternative 3 shows little change in NA 70 events on both population and housing units from existing conditions.

Noise Impacts

Figure 4-8 illustrates the NA 70 comparison for the No Build scenario with Alternative 3. The figure shows little change in NA70 events from arrivals on Runway 11 with a 1,000-foot displaced threshold, or from some larger jet aircraft circling to land on Runway 29. The arrivals on Runway 11 with the displaced threshold do not shift noise impacts northwest of TRK. The lack of significant changes for NA70 events in Alternative 3 is likely due to departure operations on Runway 29 being the significant driver for areas northwest of TRK, since departure operations generally result in more noise.

Residential Overflight

Table 4-3 presents the estimated count of population and housing units within each NA70 event color band for Alternative 3, and the change from existing.

Table 4-3: Alternative 3 Population, Housing Units, and Area with Noise Above 70 dB Events

Number Above 70 dB Events	Population	Change from Existing	Housing Units	Change from Existing	Total Area (Sq. Miles)	Change from Existing
1-2	3,811	35	3,297	-1	13.5	-0.1
2-5	2,664	-48	2,723	-27	10.4	No Change
5-10	851	No Change	640	5	5.1	No Change
10-20	1,332	10	525	5	3.2	No Change
20-50	204	-10	85	-5	2.1	No Change
Aggregate	8,862	**-13**	7,270	**-23**	34.3	**-0.1**

Source: HMMH and Mead & Hunt
Figures represent NA70 events in each individual color band.
Note: All greater than 50 NA70 dB events are located on TRK property.

The table shows no significant changes in NA70 events on population and housing units. The arrivals on Runway 11 with the displaced threshold do not shift noise impacts northwest of TRK. The noise model included the displaced threshold and selected operations circling to land on Runway 29 that may not be able to land on Runway 11 with the displaced threshold.

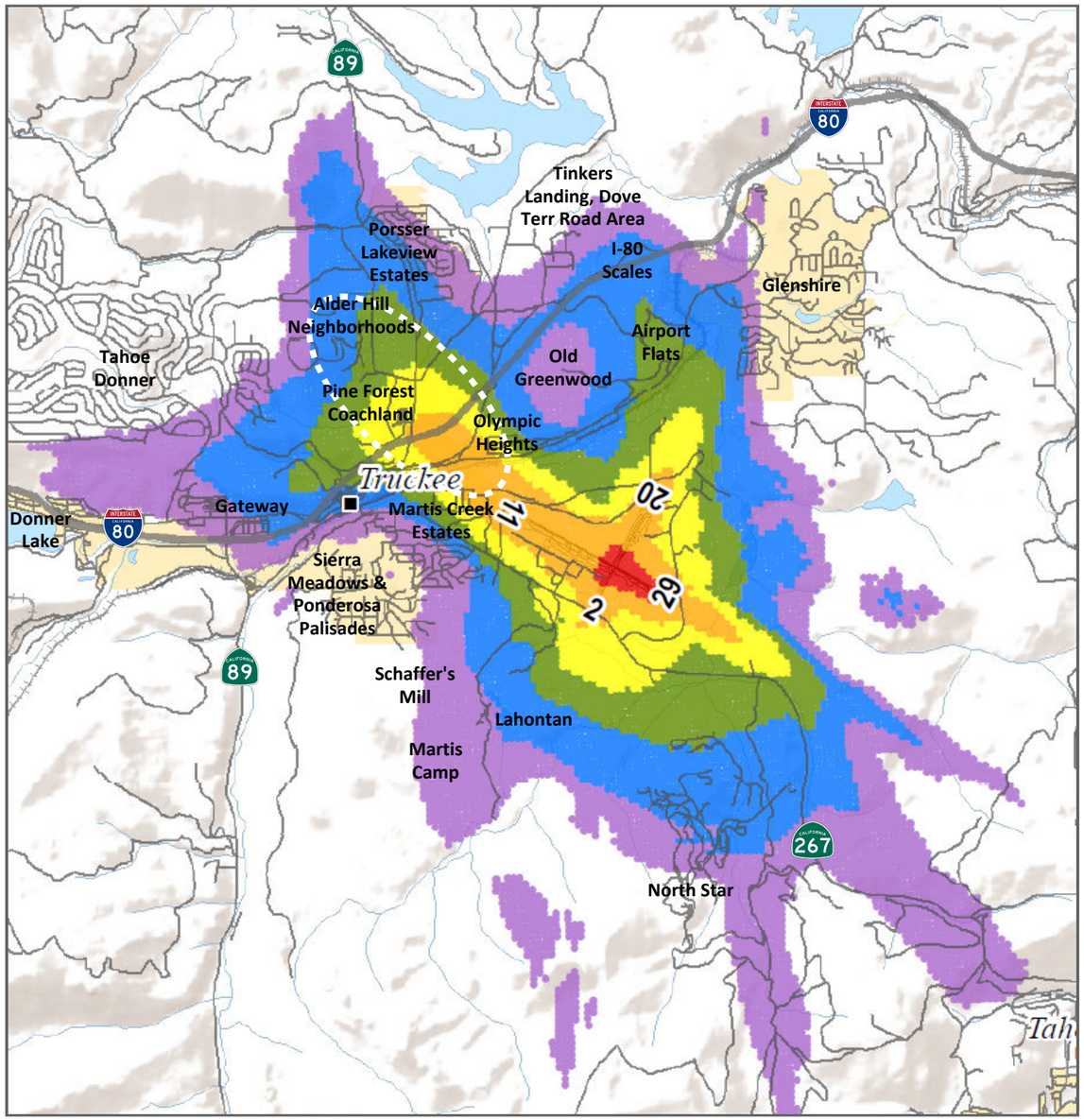
A displaced threshold may offer the perceived visual benefit of aircraft being at a higher altitude over areas under the Runway 11 approach since aircraft are landing farther down the runway. The glidepath for aircraft using the Runway 11 RNAV-GPS approach is 3.77 degrees. This equals an approach slope of approximately 15:1. By displacing the threshold 1,000 feet, aircraft would be approximately 65-75 feet above the glidepath to the existing landing threshold. The perceived increase in overflight altitude is likely not significant from a visual perception standpoint.

Future Land Use Considerations

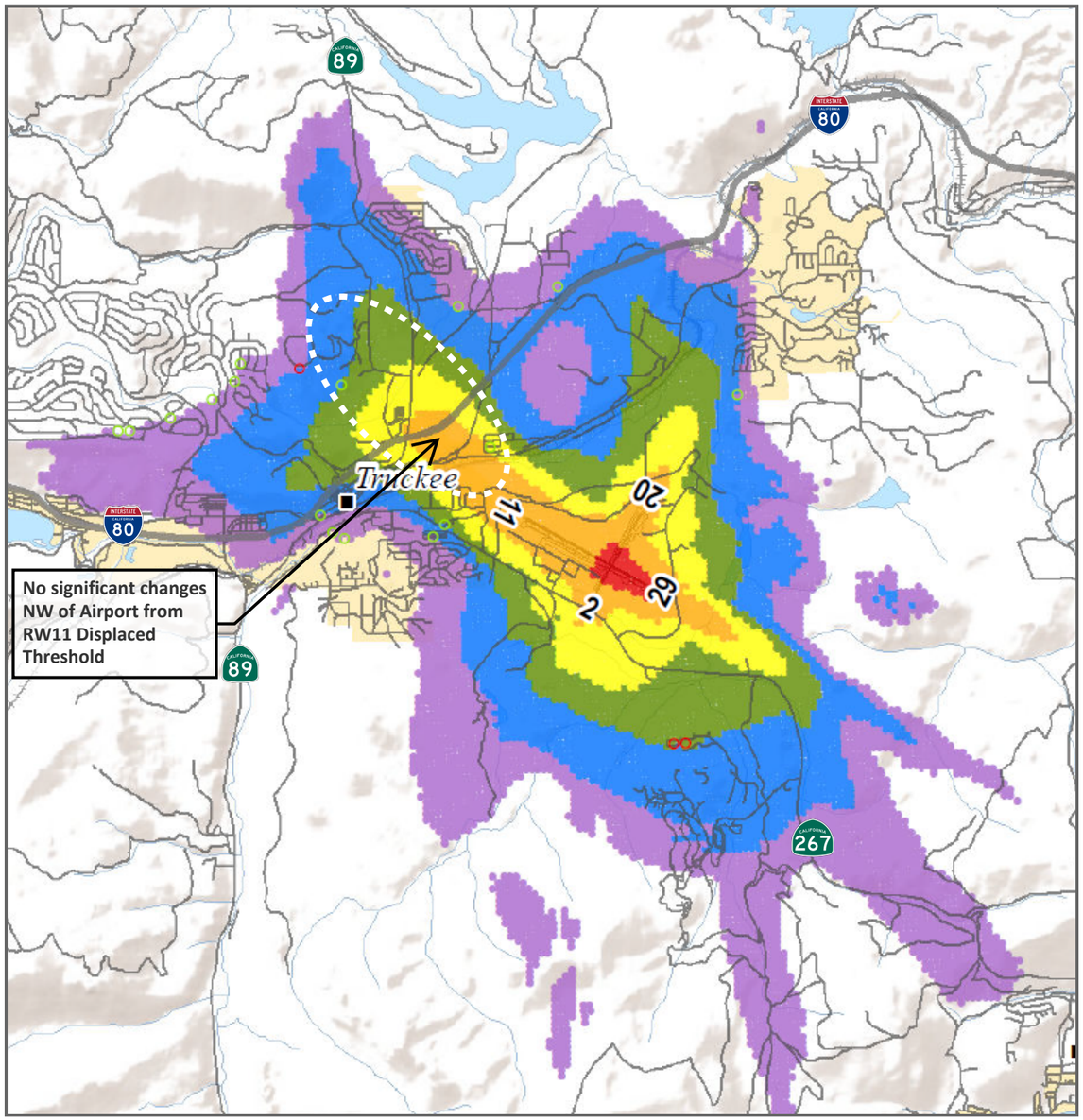
Future land use developments were considered as part of this evaluation; analysis indicated Alternative 3's impact on each site to be negligible. Descriptions of each site reviewed can be found in **Appendix F**.

Figure 4-8: NA 70 Comparison: No Build and Alternative 3

No Build - Existing Conditions



Alternative 3 - Runway 11 Displaced Threshold



Source: HMMH and Mead & Hunt
Service Layer Credits: Esri, USGS, NOAA

N

0 Feet 10,000

LEGEND

Areas with Number of Events Above 70 dB
- 1-2
- 2-5
- 5-10
- 10-20
- 20-50
- > 50 Events

- Populated Grid with a Decrease in N70 From Existing[1]
- Populated Grid with an Increase in N70 From Existing[1]
- Roads
- Urban Area
- Railroad
- Water / Stream

Notes:
Results are based on operations that represent an average annual day.

1. Populated Grid Points illustrate noise grid cells where NA70 events increased or decreased over population and/or housing units with each alternative. These points do not quantify or represent population or housing unit counts. See Noise Analysis section in the Runway Feasibility Study and Appendix E for more information on the data grid.

Alternative 3 Environmental Impacts

Full environmental screening criteria are presented in **Appendix G** and anticipates that Alternative 3 will not have significant impacts.

Relevant Environmental Categories

- Nothing significant since construction takes place on existing runway and disturbed areas.

Relevant Sustainability Categories

- Stays within existing disturbance area, using existing facilities.
- Does not require new pavement; does not increase impervious surface at the Airport.

Anticipated Level of Environmental Review

- Federal (NEPA): Categorical Exclusion
- State (CEQA): Mitigated Negative Declaration

Alternative 3 ROM Cost Estimates

The ROM Cost Estimates for Alternative 3 range from $500,000 to $650,000. This ROM estimate includes construction, design, environmental, and contingency for remarking and moving lighting.

Constructability

- No construction challenges are anticipated, as work will be completed on existing pavement and previously disturbed ground.

Maintenance

- Alternative 3 will not significantly impact or require greater maintenance or staff hours to clear in a snow event.

FAA Support

- Reducing useable runway length will likely require justification. Above noise analysis shows minimal impact for reducing overflight and landing on Runway 11.

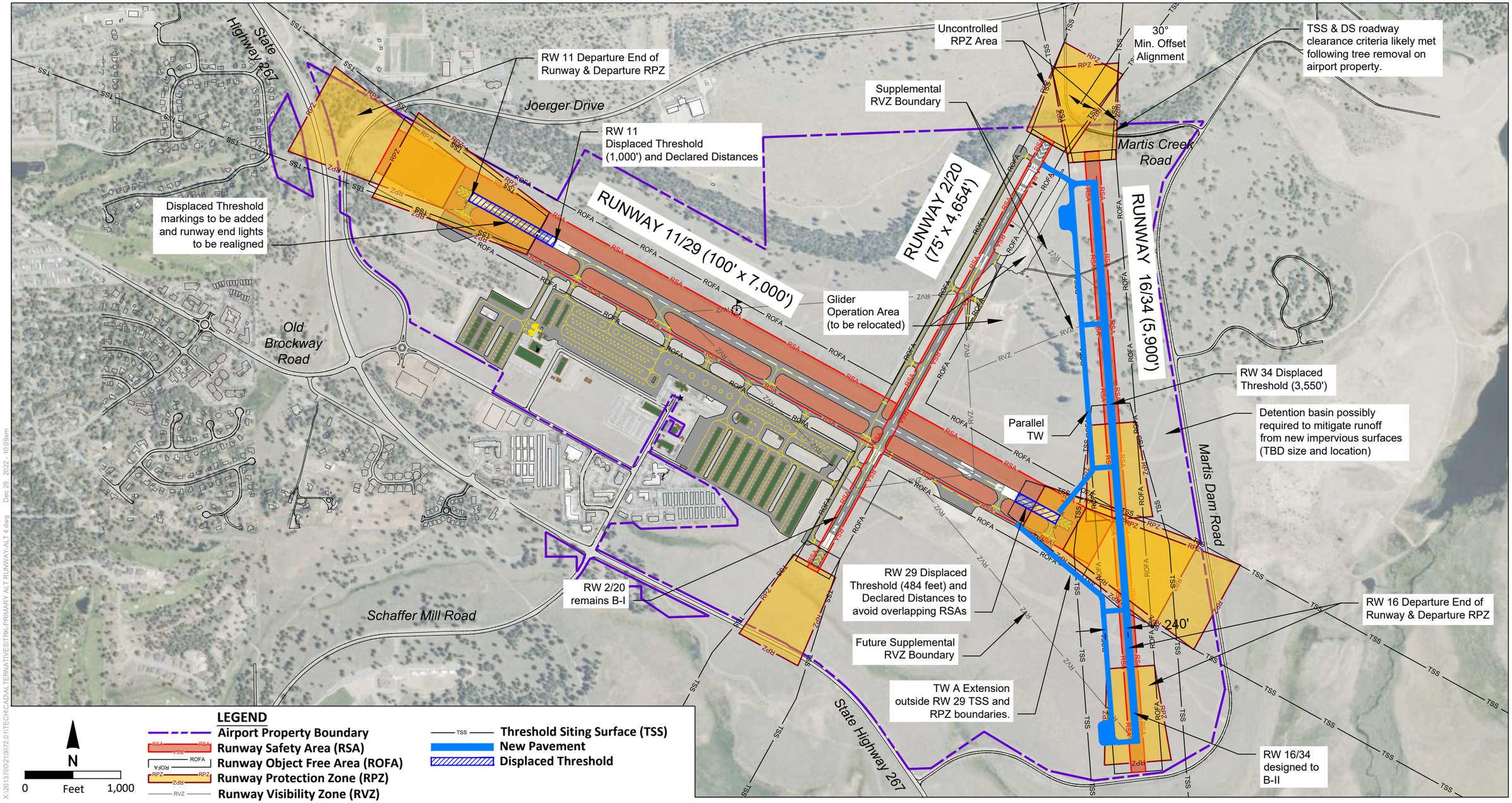
ALTERNATIVE 4: THIRD RUNWAY AND RUNWAY 11 DISPLACED THRESHOLD

Alternative 4 seeks to meet the goals of the feasibility study through a combination of Alternative 1 and Alternative 3. Alternative 4 proposes the addition of Runway 16/34 in combination with the displacement of Runway 11's landing threshold by 1,000 feet. Declared distances are proposed on Runway 11/29 to maintain standard runway safety areas, and the Runway 29 threshold shifts 485 feet to the west to maximize operational length. **Figure 4-9** shows Alternative 4 geometry with design standards and impacts to existing facilities.

Alternative 4 Airfield Operations

Same impacts as Alternatives 1 and 3.

Figure 4-9: Alternative 4 - Third Runway and Runway 11 Displaced Threshold



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Runway 11 Displaced Threshold and Third Runway 16/34

Truckee Tahoe Airport

Alternative 4 Off-Airport Impacts

Alternative 4 shows little change in NA70 events on both population and housing units from Alternative 1.

Noise Impacts

Figure 4-10 illustrates the NA 70 comparison for the No Build scenario and Alternative 4, with callouts highlighting significant changes in NA 70 events. This comparison is nearly identical to the Alternative 1 comparison, with the Runway 11 displaced threshold resulting in no change to noise impacts.

Residential Overflight

Table 4-4 presents the estimated count of population and housing units within each NA70 event color band for Alternative 1, and the change from existing.

Table 4-4: Alternative 4 Population, Housing Units, and Area with Noise Above 70 dB Events

Number Above 70 dB Events	Population	Change from Existing	Housing Units	Change from Existing	Total Area (Sq. Miles)	Change from Existing
1-2	3,847	+71	3,448	+150	11.1	-2.5
2-5	2,383	-329	2,262	-488	9.6	-0.8
5-10	977	+126	530	-105	4.9	-0.2
10-20	1,196	-126	471	-49	3.6	+0.4
20-50	87	-127	39	-51	2.2	+0.1
Aggregate	8,490	**-385**	6,750	**-543**	31.3	**-3.1**

Source: HMMH and Mead & Hunt
Figures represent NA70 events in each individual color band.
Note: All greater than 50 NA70 dB events are located on TRK property.

The table shows similar results as Alternative 1: a mix of population areas and housing units that both increase and decrease with NA70 impacts. On the aggregate, both population and housing units experience a decrease in noise events. The Green 5-10 event band is increasing events on population. This is likely a product of shifting noise events and having these population areas moving out of the Yellow 10-20 and Orange 20-50 events bands. The same is true for the Purple 1-2 event band, as this shows increases in population and housing units, mostly from a shift from the Blue 2-5 event band.

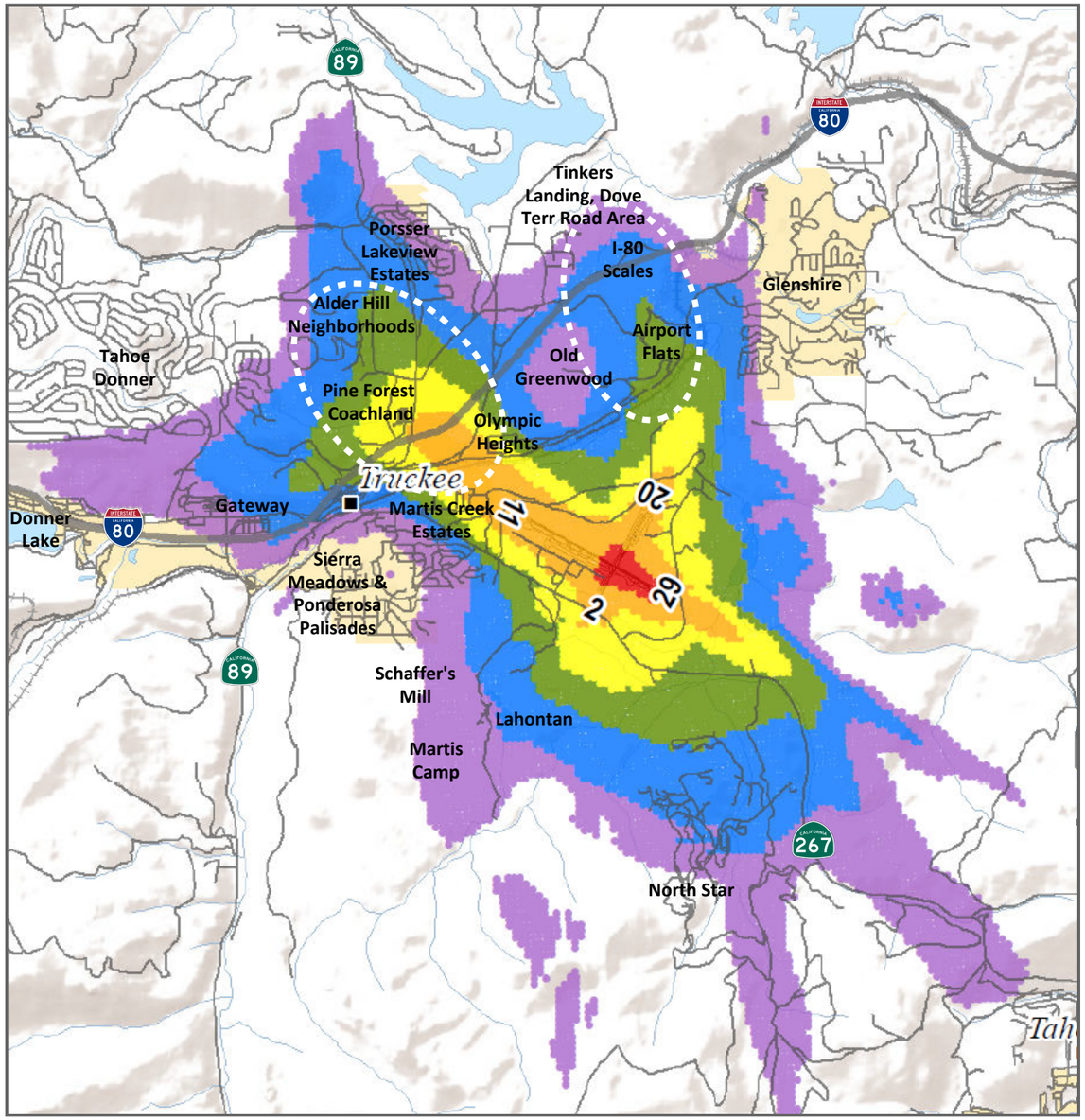
As described in Alternative 3 above, the displaced threshold results in aircraft being approximately 65-75 feet above the glidepath to the existing landing threshold. The increase in overflight altitude is likely not significant from a visual perception standpoint and does not result in a significant change in NA70 events under the Runway 11 approach.

Future Land Use Considerations

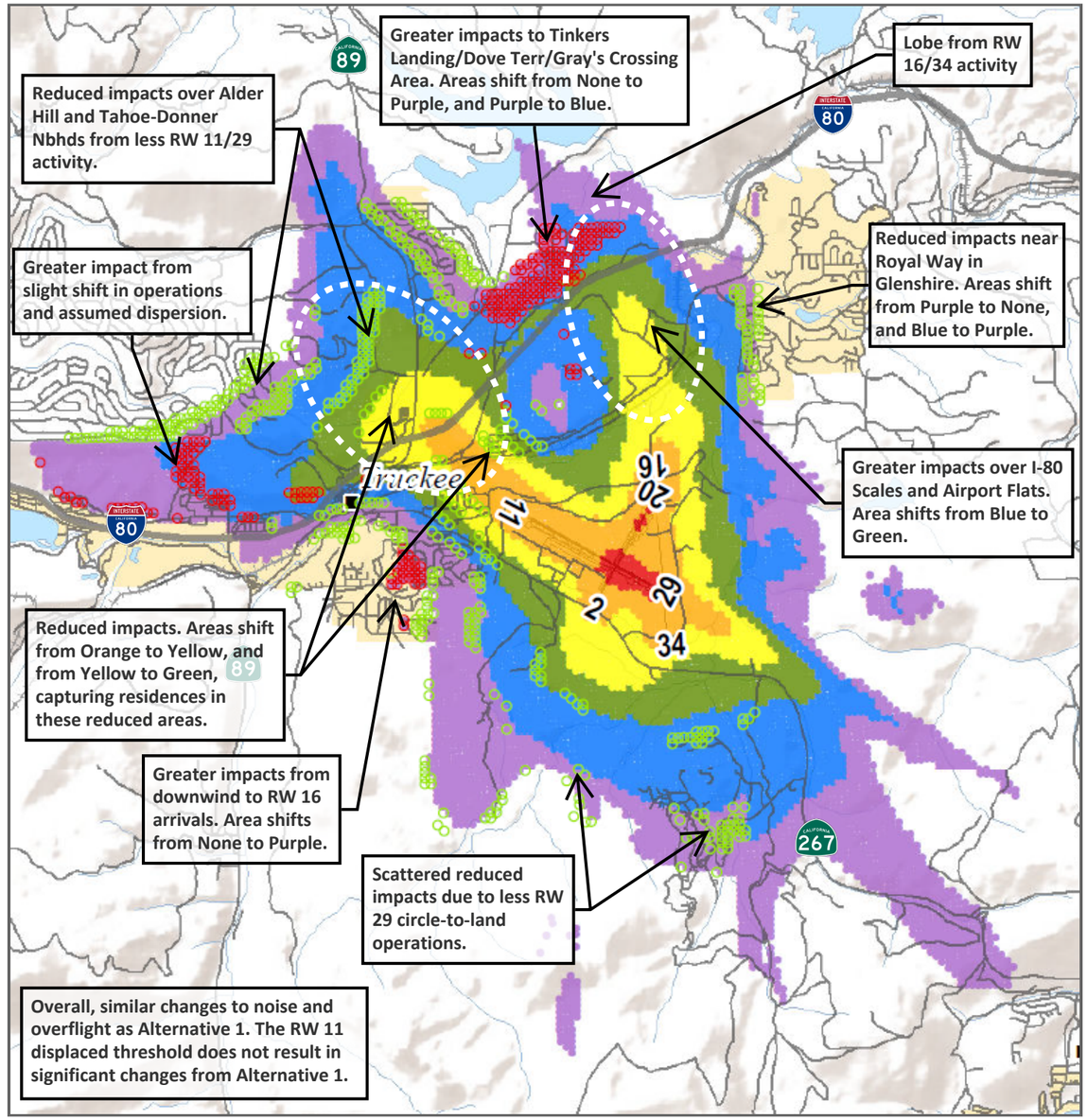
Future land use developments were considered as part of this evaluation; analysis indicated Alternative 4 impact on each site was found to be negligible. Descriptions of each site reviewed can be found in **Appendix F**. Alternative 4 will require an update of the Airport Land Use Compatibility Plan (ALUCP) to include Runway 16/34.

Figure 4-10: NA 70 Comparison: No Build and Alternative 4

No Build - Existing Conditions



Alternative 4 - Third Runway and Runway 11 Displaced Threshold



Source: HMMH and Mead & Hunt
Service Layer Credits: Esri, USGS, NOAA

N

0 Feet 10,000

LEGEND

Areas with Number of Events Above 70 dB
- 1-2
- 2-5
- 5-10
- 10-20
- 20-50
- > 50 Events

- Populated Grid with a Decrease in N70 From Existing[1]
- Populated Grid with an Increase in N70 From Existing[1]

- Roads
- Urban Area
- Railroad
- Water / Stream

Notes:
Results are based on operations that represent an average annual day.

1. Populated Grid Points illustrate noise grid cells where NA70 events increased or decreased over population and/or housing units with each alternative. These points do not quantify or represent population or housing unit counts. See Noise Analysis section in the Runway Feasibility Study and Appendix E for more information on the data grid.

Alternative 4 Environmental Impacts

Alternative 4 would incur the same anticipated environmental and sustainable impacts as Alternatives 1 and 3. The anticipated levels of review would also not change, with the significant impacts from Runway 16/34 construction.

Anticipated Level of Environmental Review

- Federal (NEPA): Environmental Assessment
- State (CEQA): Environmental Impact Report

Alternative 4 ROM Cost Estimates

The ROM Cost Estimates for Alternative 4 range from $41 to $49 million. This ROM estimate includes construction, design, environmental, and contingency. This ROM estimate includes construction, design, environmental, and contingency for Runway 16/34 and associated taxiways, plus the displaced threshold change on Runway 11. The ROM range includes options for a 75- or 100-foot-wide Runway 16/34. Alternative 4 would include the same constructability and maintenance items as Alternatives 1 and 3. FAA eligibility for both options would require justification.

RUNWAY ALTERNATIVES SUMMARYS

Significant benefits and disadvantages for each alternative are listed below, with comparisons and suggested next steps. The conclusions reached here are from analysis above.

This Runway Feasibility Study is intended to be an objective analysis of the four runway alternatives. It is recommended the TTAD Board make decisions on next steps, the preferred alternative, and how to proceed with Phase 2 of the Master Plan.

Alternative 1 Summary

This Study focused on implementing Runway 16/34 and whether this would reduce overflight and annoyance on residences, as compared to the existing condition and the other alternatives. **Alternative 1 meets this Study's primary goals of reducing residential overflight and noise in the aggregate, compared to Existing Conditions.** These benefits are offset by impacts to existing facilities, likely environmental impacts, and significant ROM cost estimates. Major benefits and disadvantages of Alternative 1 are listed below.

Alternative 1 Major Benefits:

- Adds runway with clear approach and departure path to north that offers best approach minimums (LPV approach) and departure climb gradient.
- Reduces aggregate noise impact on population and housing units, as measured with NA70 metric.

Alternative 1 Major Disadvantages:

- Impacts Runway 11/29 operational length, which may complicate FAA support.
- Used as contraflow runway only, with operations to (departures) and from (arrivals) the north.
- May not shift as many operations by types of operators (turboprops and jets) as was intended by building this runway.
  - Operators may still choose to use Runway 11/29 during calm wind conditions, according to pilot interviews.
- Potential to increase operations with introduction of LPV approach, according to pilot interviews.
- Runway 16/34 may effect efficient operations during peak operation times, according to ATC.
- Impacts existing glider facility.
- Potential for unknown cultural resource impacts or mitigation that may increase cost and complexity.
- Offers significantly higher ROM cost estimate and ongoing maintenance than other alternatives.

Alternative 1 Comparison to Existing Base Case

Compared to the existing runway configuration, NA70 analysis shows reduced impacts on population and housing units in the aggregate with the implementation of Runway 16/34 and the estimated shift in operations to this alignment. While reducing impacts in the aggregate, Alternative 1 does shift some noise and overflight to other neighborhoods. Major facility improvements would be required.

Alternative 1 Comparison to Other Alternatives

Alternative 1 reduces NA70 events for population and housing units slightly more than Alternative 2. However, this comes with greater costs, higher ROM cost estimates, greater impacts to existing facilities and runway utility, and potentially greater environmental impacts.

Compared to Alternative 3, Alternative 1 is more complicated to implement with significantly higher costs and facility impacts but will result in an aggregate reduction in residential noise events.

Alternative 1 Conclusion

Ultimately, if the Alternative 1 Runway 16/34 scenario is preferred, the benefits of the reduction in NA70 events, noise impacts, and overflight on population and housing units in the aggregate should be weighed versus the costs, eligibility, and environmental impacts outlined in this Study.

Alternative 2 Summary

This Runway Feasibility Study included extending and widening Runway 02/20, as was the Preferred Alternative in the 2015 AMP. **Alternative 2 meets this Study's primary goals of reducing residential overflight and noise in the aggregate, compared to Existing Conditions.** These benefits are offset by likely environmental impacts and significant ROM cost estimates. Major benefits and disadvantages of Alternative 2 are listed below.

Alternative 2 Major Benefits:

- Lengthens Runway 02/20 to over 5,000 feet opening this runway up to bigger classes of turboprops and jets.
  - Majority of pilots surveyed indicated they may use this runway more, if lengthened.
- No major impacts to existing facilities or airfield geometry.
- Reduces aggregate noise impact on population and housing units, as measured with the NA70 metric.
- Significantly less expensive, according to ROM cost estimates, than Alternative 1.
- Already included on the FAA approved Airport Layout Plan (ALP).

Alternative 2 Major Disadvantages:

- Alignment does not offer LPV approach or lower departure climb gradient.
- Potential for unknown cultural or wetland resource impacts or mitigation that may increase cost and complexity.

Alternative 2 Comparison to Existing Base Case

Compared to the existing runway configuration, NA70 analysis of the extension of Runway 02/20 shows a reduction in noise and overflight impacts on population and housing units in the aggregate, with the estimated shift in operations to this runway. Alternative 2 does shift some of these impacts to other neighborhoods.

Alternative 2 Comparison to Other Alternatives

Compared to Alternatives 1 and 4, Alternative 2 offers significantly less ROM cost and impacts to existing facilities. Alternative 2 does reduce noise and overflight on residences, but not as much as Alternatives 1 and 4. Alternative 2 will likely be viewed more favorably by the FAA than Alternatives 1 and 4, with the documented reduction in noise impacts and overflight of housing units, combined with no major impacts to existing aeronautical facilities (Runway 11/29 length and the glider facility).

Compared to Alternative 3, this provides more benefit for overflight impacts and increases runway length (opposed to reducing with the displaced threshold on Runway 11).

Alternative 2 Conclusion

If Alternative 2 is preferred, this may be met with more support from the FAA over Runway 16/34, based on the analysis. There may also be more opportunity for Runway 02/20 to be extended farther to the south and closer to 6,000 feet in length. This would require refining the alternatives for this runway in Phase 2 to analyze any wetland impacts and rerouting drainage. But this may be possible as standards for off-airport land use in RPZs have been updated since the 2015 AMP, when the RPZs were required to be maintained on TRK property.

Also, the option for widening Runway 02/20 from 75 to 100 feet may not be supported by the FAA, and there was opinion from pilots interviewed that the difference between 75 and 100 feet in width may not entice more operations. The interviews are summarized in **Appendix C**. Lengthening Runway 02/20 to 5,055 while at same time retaining its current 75-foot width may have the same desired increase in use and significantly reduce ROM costs.

Alternative 3 Summary

This Runway Feasibility Study included displacing the landing threshold by 1,000 feet on Runway 11. **Alternative 3 does not significantly reduce residential overflight and noise in the aggregate, compared to Existing Conditions.** Major benefits and disadvantages of Alternative 3 are listed below.

Alternative 3 Major Benefits:

- Compared to other alternatives, low ROM costs.
- Compared to other alternatives, relatively simple to implement.
- No major environmental or sustainability impacts.

Alternative 3 Major Disadvantages:

- Impacts Runway 11/29 operational length, which may cause complications with FAA support.
- Will likely not move a significant number of operations to other runways.
- Pilots interviewed were not in favor of Alternative 3 and stated the reduced landing length on Runway 11 decreases safety margin, which may increase potential for overruns, or will result in more circling to land operations to Runway 29.

Alternative 3 Comparison to Existing Base Case

Compared to the existing runway configuration, NA70 analysis shows no significant reduction in impacts on population and housing units in the aggregate with the Runway 11 displaced threshold.

Alternative 3 Comparison to Other Alternatives

Alternative 3 does not show a significant reduction in impacts on population and housing units in the aggregate compared to Alternatives 1 and 2.

Alternative 3 Conclusions

Operators where not in favor of reducing the landing length on Runway 11. Some operators opined reducing landing length on Runway 11 may diminish the safety margin for two reasons. For one, this would force larger aircraft flying the Runway 11 IAP to circle to land on Runway 29. Second, operators who know TRK well may continue to use Runway 11 if it was a 7,000-foot runway, and land as close to the new threshold as possible, increasing the probability for overruns.

Data analysis of winds and operations found a small amount of jet operations arriving on Runway 11 when winds are calm or do not favor this runway. Based on the quantitative analysis of matching winds with past operations and the qualitative comments from current operators, it was determined that operations would not be significantly altered from the displaced threshold. **Alternative 3 is not recommended due to no significant shifts in noise impacts, combined with the potential to decrease safety margin from landings on Runway 11.**

Alternative 4 Summary

This Runway Feasibility Study included adding Runway 16/34 and displacing the landing threshold on Runway 11 1,000 feet. **Alternative 4 does not significantly reduce residential overflight and noise in the aggregate, compared to Alternative 1. Alternative 4 is not recommended** for the same reasons that Alternative 3 is not: the potential to decreased safety margin from landings on a shorter Runway 11 and no significant shifts in noise impacts.

NEXT STEPS

Following the submission of this Draft Feasibility Study to TTAD for review and comment, feedback and comments will be incorporated into the Final Draft Feasibility Study. The Final Draft will include a recommendation and decision point for the preferred runway alternative. The preferred alternative will be a critical component to be considered in Phase 2 of the Master Plan Update project.