Chapter Fourteen
Designing for Challenge

Ride Safe, Ride Smart, Always

Section 1: Challenge versus Sustainability

Like any other modality, an integral part of trail riding is challenge: riders constantly push themselves to determine how good they are and how good are their machines. Challenging trails or features can provide a boost of fun, excitement, extended seat time, camaraderie, and self-confidence if the rubber side stays down. By choice, they take riders out of their comfort zone. Adrenaline is pumped out as riders negotiate challenge and are left with a rush of endorphins as they complete the challenge. This creates a chemical high that contributes to the "WOW! That was a great trail!" feeling at the end of the day. These experiences and sensations are desirable and when trail planners provide them, they are definitely providing for the riders' needs.

Riders are constantly testing themselves and their machines

The issue, though, is how to provide for those needs and still have a sustainable trail. As one group of riders said: "We want sustainable trails, but don't take away our hillclimbs." In most cases, this is an oxymoron. In an era of rules like the 50 percent rule and the 10 percent average grade rule, it can be easy to design out excitement and challenge. That is why trail planners focus on making informed decisions on a given site rather than on conforming to rules. In many cases, planners and designers may have more latitude than they think.

Providing Sustainable Challenges

There are five ways to create and provide challenge: 1) utilize natural features; 2) utilize design features; 3) utilize manufactured topographic features; 4) utilize natural topographic features; and 5) utilize manufactured design features. A good designer will use all five, either independently or together, to create the desired experience.

1. **Utilize natural features.** These are features like rock outcrops, boulders, rock step-ups, scree, slab rock, slick rock, and cliffs. Notice that these are all rock features. Rock is generally more durable than soil and offers opportunities for a varied and challenging riding experience. Riding a smooth surface trail can be fun, but throwing in some rocks occasionally can increase that fun.

Soil type also fits into the natural feature category. Often, designers don't have a choice of the soil type that the trail goes through, but if they do, soil type can definitely affect challenge level. In dry climates, sandy soils are more challenging than silt or clay. In wet climates, silt turns to mud and clay turns into slick gumbo, but wet sand holds up quite nicely.

Very steep, but very durable. Bulldogging can be part of the challenge and definitely part of the experience. The crude board bridges a vertical step-up and the designer was being cursed, but what was talked about the most around the fire that night?

Although rocks are durable, the soil around them usually isn't as durable. Going from rock to rock can work well, but going from rock to soil to rock may result in considerable soil displacement. On some trails, ledges will continue to get higher as tires displace the soil at the base of the ledge. Eventually, even experienced riders may start looking for a bypass. Designers should anticipate this and harden the approaches to these features if possible.

Erosion has probably occurred to expose this bedrock, but now it is durable and provides a great challenge feature. Challenge varies by vehicle type. This feature could be moderate for an ROV or 4WD, difficult for an OHM, and very difficult for an ATV.

2. **Utilize design features.** While topographic features may be limited, there are a host of design features available, including grade, vertical alignment, horizontal alignment, obstacles, clearing, tread, and exposure.

Okay, we know that this is a fall line trail that doesn't harmonize with the landscape, BUT, it is a fun, challenging hillclimb. Given the durable soil type, climate, level of use, and type of use, this trail is sustainable though it could be managed better to reduce the number of approach lines. Design is about assessing the site and making informed decisions.

Grade is one of the challenge features that riders like the most, but it's also one that can cause the most impacts. The key is for designers to look at a given situation and make an assessment on how steep the grade can be. Grade pitches, even short ones, can increase the interest and variety of the trail.

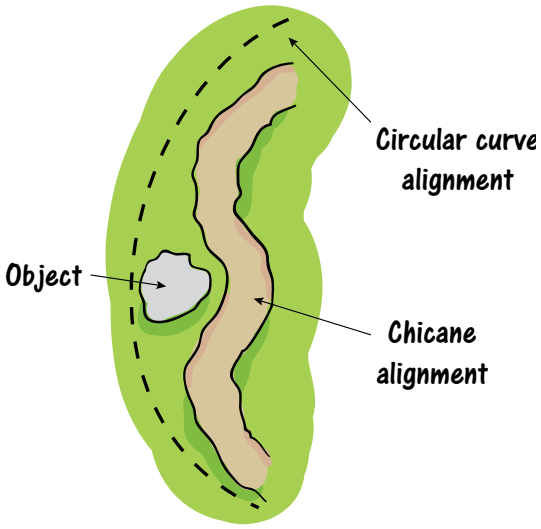
Even if there aren't steeper pitches, keeping the **vertical alignment** moving increases difficulty while increasing sustainability and fun factor, and reducing speed.

Good horizontal and vertical movement

As with vertical alignment, it is important to keep the **horizontal alignment** moving. Take advantage of tree or brush thickets to tighten up the alignment. The tighter it is, the more technical it is. If ATVs and ROVs have to back up to negotiate a turn, up to a point it makes the trail more challenging. Compound curves, broken back curves, and non-circular curves can increase difficulty by decreasing flow, but they can also increase tread impacts.

Chicanes are another tool to slow down riders and increase challenge. A chicane is a feature that creates another set of turns, so a chicane hugs a rock or a tree where a circular curve goes around the rock or tree. Chicanes interrupt flow and are okay on tight and technical alignments, but shouldn't be used on open and flowing alignments without slowing the riders down first.

Chicanes



A good example of a chicane. An ATV riding at speed around the curve gets thrown at the tree with the flagging on it. Flow is reduced and challenge is increased, but is this appropriate on an Easiest trail? It could be depending on the alignment before and after this section.

This is a very abrupt chicane. The tree tends to stick out into the middle of the trail. It's been hit by the equipment and could easily grab an unwary rider, especially one riding toward you in this picture. Is this challenge or risk? One designer called it risk and another designer said challenge.

Obstacles are a great way of increasing challenge. The issue with using obstacles is that they can be removed over time through maintenance or by well-intentioned riders trying to help out. If obstacles are intended to be left for challenge features, they must be documented in the TMO, and the intent of the TMO must be communicated to the maintenance personnel. Riding over obstacles like roots, rocks, and stumps can increase the degree of challenge.

Roots can increase challenge, especially ones like this that are at an angle and on a curve.

Six elements can affect the degree of challenge with obstiacles: size, frequency, stability, traction, location, and position.

1. Size. Certainly, larger objects are more challenging to ride over than smaller objects. There are guidelines for size, but really, there are too many variables to say that one size is more difficult than another size. Using a variety of obstacles can also affect the challenge of a trail.

2. Frequency. Getting over a single rock is one thing, but negotiating a rock garden is another as abrupt physical forces direct forward momentum sideways or backward.

3. Stability. Riding over an obstacle that is loose or rolls is more challenging than riding over one that is firmly embedded.

4. Traction. Challenge increases when traction decreases, so an object that is wet, smooth, or slimy with moss or mud is more difficult to negotiate than one that is dry and rough.

These loose rocks of different sizes and shapes increase the challenge of this climb.

5. Location. Obstacles on curves are more challenging to negotiate than those on tangents because the riders are trying to turn the vehicles against forces that are directed forward and outward. Loosing tire contact or hitting an obstacle that throws the vehicle outward forces the rider to quickly react to keep the vehicle going in the direction of the turn. On a tangent, riders are more likely to see objects approaching and gauge speed and position appropriately, but that advantage is generally lost in a curve.

6. Position. Obstacles that are, or have surfaces that are, at an acute angle to the trail tread are more challenging to negotiate than those that are perpendicular to the trail tread. As the degree of angle decreases, the degree of challenge increases.

These angular log waterbars add to the challenge of this trail, however, the challenge features shouldn't be your drainage structures. Forces are exerted on these by vehicles going uphill and the log in the middle was probably displaced by those forces.

Putting all of these elements together, the most challenging scenario would be many large, loose, slippery, and smooth obstacles placed in a curve. What if the trail doesn't have any obstacles? Import them, or instead of wasting slash during trail clearing, bring some of it back in after construction and stake it in place to create obstacles.

This log adds challenge by being at an acute angle to the trail. It tends to throw the rider out of the curve rather than into the curve. No bark means less traction and when it's wet the challenge level increases.

Soil type can play an important part in deciding whether or not to incorporate obstacles. It takes traction to negotiate obstacles. While soft soils can increase technical challenge, that can also equate to unwanted tread impacts and maintenance costs as less skilled riders spin their tires to negotiate obstacles.

The properties of most soils change as the weather changes and with that the rideability and challenge changes, sometimes dramatically in just a few hours. This is a factor that designers need to consider when playing with alignment and features. As friction or traction changes, so does the level of challenge. Also, as the cohesiveness of the soil decreases, its resistance to displacement decreases, so what was a durable challenge feature one day, may not be so durable the next day.

The same idea in good soils will work just fine. Logs should be staked so they don't move. It also makes them less likely to be cut out by a well-intentioned rider.

Clearing width should be kept tight. The narrower it is, the slower the riders will go. They'll go even slower if there is a risk of losing a fender or breaking plastic. That risk equates to challenge. Having green leg slappers or brush scraping down the side of a vehicle not only slows and confines the use, it gives riders the illusion that they are pioneering a trail. It also affects their perception of safety.

Though short and not very steep, these soils displace easily when wet. This trench will continue to get deeper until the soil type changes or the tread is hardened. If it is hardened, the challenge level may decrease, but the grade and terrain feature will be perpetuated.

Vertical clearing or pruning height can also challenge riders and enhance their experience. Designers can create a tunnel effect; but brush is one thing, immovable objects like logs are another, especially if vehicles without roll bars are using the trails. Designers need to take extreme care to ensure that the speed is down and that riders have adequate time and visibility to see the overhanging log. This practice places the agency at risk. What if the log breaks and becomes a spear? What if vegetation grows in so riders can't see it coming? It's a poor practice and not worth the risk.

The stump and tree on the tread shoulder increase the challenge of negotiating this curve. Though easy for an OHM, it's very tight for an ATV.

There are guidelines for clearing height and width, but many of them appear to be founded on reducing agency risk rather than increasing rider experience. Designers should look at the TMO and then assess what features or opportunities they have on site to create the desired experience.

A rough, inconsistent **tread** is more challenging to ride than a smooth, consistent one. The design elements for tread are: width, irregular tread surface or rugosity, and irregular tread plane.

Width. A narrower tread has the same effect and benefits as narrower clearing. Note: Narrower equals challenge equals reduced speed; wider equals less challenge equals increased speed. Changing the tread width can add variety and challenge if it's consistent with the TMO. A good design tool is a choke, which is a narrowing of the trail tread accompanied by a restrictor like trees or rocks. These are similar to a gateway or anchor except that the tread width is less than the design standard. Chokes slow riders down by reducing their perception of safety: "Am I going to fit through that?" These are good in advance of junctions, technical sections, or anyplace else designers want the riders to slow down. Unless the speed is already slow or the trail is extremely technical, it is essential that riders have adequate sight distance to see the choke coming and prepare accordingly to negotiate it.

You can see this vertical obstacle coming, it's marked with an arrow, and it definitely slows the rider down. Challenge, yes; worth the risk, no. It is too low.

The high sides and rocks increase the difficulty of this trail and leave little room for a margin of error.

A narrow tread on an open slope like this reduces the margin for error, reduces the riders' perception of safety, and therefore increases the feeling of challenge.

A similar tool is the perceived choke. With these, the tread does not narrow up, but the clearance between trees or obstacles does. Usually, the trail corridor is cleared for a specified distance wider than the trail tread so that tree trunks are away from the trail shoulder, but tree limbs could still protrude into the trailway. Except for single track, OHV trail treads are wider than the machine. When there is zero clearance from the shoulder to the trees, there is adequate width for the ATV, ROV, or 4WD to pass through, but the riders' perception is that it is too narrow and they will brake hard.

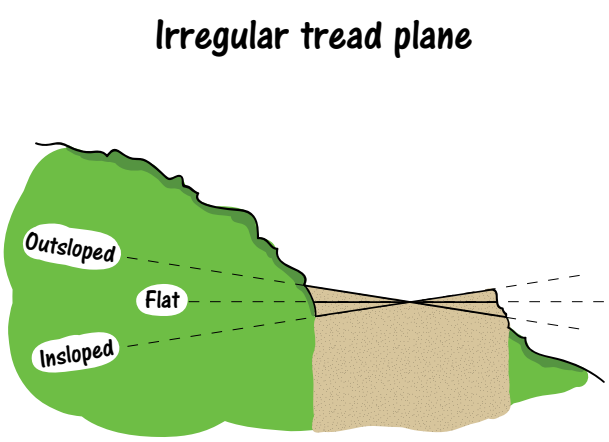
Here the tread is so narrow that riders must put a tire up on the rock on the left to get through. This can tip the vehicle toward the right which increases the risk of a bent rim, a broken bead, and scratched or broken plastic.

This is a good choke. Passing through this, the riders tend to stand as they wonder if the foot pegs are going to clear the rocks.

This is a great choke with a narrow tread and tight vertical confinement. The risk of losing plastic or damaging fingers is high as the bars have to be angled to fit through the gap. The rock obstacle in the middle of the tread (arrow) adds to the challenge.

Chokes serve as anchors and gateways. If the restrictors are less than wheel height, the riders will slow up much less than if they were above wheel height because they are less of a perceived threat. The higher the restrictors, the more intimidating they become.

Irregular tread surface or rugosity. This would include rutted or uneven trail treads. This increases challenge because riders often cannot choose their line and are forced to fall into a rut or try to stay out of one. Ruts are often associated with poor drainage and erosion or lack of maintenance, but they can be beneficial. If the issue is drainage, fix the drainage and leave the ruts for challenge if consistent with the TMO. Or, don't fix it if the erosion isn't damaging.



There are some obvious drainage issues going on here, but the irregular tread surface and the ruts that zig-zag from one track to the other make this hill quite challenging and fun. If the source of the water was dealt with before it reached the crest of the hill, this level of challenge could be perpetuated.

Irregular tread plane. The normal trail prism is flat, insloped, or outsloped, but what if the tread did all three randomly and unexpectedly? Pitching side to side changes the directional physical forces of the vehicle and requires corrective action by the riders. This increases the challenge level. In slippery soils, an outsloped curve on a steep slope can be dicey to negotiate.

In playing with natural features and design features, designers can increase the challenge by reducing flow. Rocks, obstacles, irregular tread widths and planes, clearing widths, and irregular alignment all affect how the trail flows and thus how easy or difficult it is for the riders to negotiate that flow.

When a rider is placed in a situation where a mistake could lead to equipment damage or loss, personal injury, or death; that is called **exposure**. Exposure equals challenge. Exposure is usually, but not necessarily, associated with cliffs or very steep, open sideslopes. When a rider is on a narrow trail and it is 1,000 feet almost straight down to the river; that is exposure. Add in an outsloped tread, obstacles, and slick soils and the degree of exposure has been compounded.

Exposure is the ultimate mind game. Here the driver of the ROV can't see the ground in front or the tire placement as the machine is negotiates down the rock.

From a challenge standpoint, the designer has several options: exclude exposure sections, include exposure sections if consistent with the TMO, change the length of exposure, and change the frequency of exposure.

To manage risk, it is important that exposure be reflected in the difficulty level of the trail, usually black diamond or double black diamond depending on the degree of exposure. Good entrance management and filters should also be employed to inform and limit unskilled riders. Since exposure can be an extreme challenge, it should be highlighted on the trail map and website and should include additional signing at the trail entrance.

Extreme? Yes. Edited photo? No. Who would do this? More than you think.

Tip, Trick or Trap?

Trap: Designers can fall into the trap of laying out trails which keep them comfortable or ones they like; not what keeps their customers comfortable or happy.

Like chokes, there is real and perceived exposure. Real is when riders are on the edge of the cliff and perceived is when they think they're on the edge of a cliff. When a vehicle is pitched up and off-camber and riders can't see what the ground is doing in front of them or where and how the tires are going to come down, that is perceived exposure. This is a really cool tool.

Certainly not as dramatic, but exposure nonetheless. The designer can control the degree of exposure.

3. **Utilize manufactured topographic features.** Manufactured topographic features include the remnants of extraction activities like rock pits, quarries, open-pit mines, and borrow pits; old landings; drill pads; processing and transfer sites; and runways (that is, any large area that has been used for another activity). What is good about these? They are already heavily impacted sites, so they are often a wash from a resource standpoint. As such, they offer an opportunity to be used as OHV facilities where high impact use could occur with little impact on the environment.

In this project area, designated open areas in cinder pits like this provide the only hillclimb opportunities. Cinders are like marbles so they enhance the challenge for the riders.

The sites in remnants of extraction activity areas could be used for OHV training areas, mudding, pit squid activity, hillclimb, and rock crawl by 4WDs, ROVs, and ATVs. These sites are often referred to as play areas or open areas that have little or no development.

The large areas that have been used for another activity could now also be used for OHV training areas, MX tracks, and technical challenge courses like terrain parks and endurocross. These activities require a higher level of development and often a higher level of maintenance for which management may not want to assume responsibility.

There are segments of people in the OHV community who have little interest in trails. These include rock crawlers, dune riders, mud riders, MX riders, pit squids, and often younger kids. Open areas provide places for these activities to occur. Some people think that open areas are just sacrifice areas. Not so. Like trails, they are designed and managed for a specific use or activity. In addition to providing a place for challenge and high-impact activities, open areas are excellent OHV management tools. When legal areas exist to do non-trail related activities, trail managers or rangers can direct the use away from non-legal areas to the legal areas. It is always better to work with human nature than against it.

An argument against open areas is that if designers provide for that use, they are telling the public that those activities are acceptable. Not at all, and in fact the opposite. What designers are saying is that those activities are not acceptable elsewhere, but they are acceptable here and only here.

Liability often comes up in discussions about open areas. The bottom line is that there is liability in everything. The issue is how the risk is managed. Play or open areas need to be signed that the area is to be used at the riders' own risk. The designers may add rocks for a rock crawl, a couple of simple dirt mounds for kids, or a mudding area, but as long as the designers aren't constructing technical features like doubles, triples, and table tops that require precise construction and maintenance, the risk is low. Unless a trail team member carelessly does something that changes the condition of the site without signing or warning of the change (like dumping storm-damaged culverts or a bridge, removing the back half of a mound, or creating a vertical face where it was once sloped), the risk is managed.

This small ½-acre open area is just an oval with four mounds of dirt for kids to ride. It has received heavy use and the mounds have worn down to a ¼ of their original size and need to be rebuilt.

As a test, 4WDs were invited to try out this OHM and ATV play area. They had a blast! Heavy equipment was brought in to enhance some runs and it is now a designated rock crawl facility as well.

Almost any size area can be used from a quarter acre to 40 acres or more. Depending on the expected use level, the bigger the better; but anything is usually better than nothing.

Since open areas are designated sites, there needs to be signing to identify the site, and the perimeter of the area should be clearly marked with boundary markers.

4. **Utilize natural topographic features.** Natural topographic features include any area where unrestricted cross-country riding is allowed. These are usually sand dunes, scab flats, rock knobs, or hills that have durable soils. These open areas are natural features, not commercially impacted features. Like the open areas discussed above, they are designed and managed to accommodate a specific use or activity and they need to be signed accordingly. They can offer high speed, high fun, and high challenge.

In the winter, open areas can offer a whole different experience and challenge level.

Some examples of effective open area signing. If the project includes open areas, their signing should be included in the sign plan.

Riding sand is an entirely different OHV experience. If it looks easy, it isn't and the challenge can be extreme.

High rock content make the soils in these hills suitable for open hillclimbing.

An area with boulders, rock slabs, and step-ups can be perfect for trials riders.

Natural terrain like this can provide some WOW challenge opportunities. The driver and this machine performed some awesome maneuvers. Large rock formations like this can also make great areas for a trials course.

One use for natural topographic features is as observed trials courses. What trials riders can do on a motorcycle is amazing. Like rock crawl, they need a variety of large obstacles and since it is a spectator sport, public access to the site is important. Very slow speeds and very low tire pressures make this a low-impact activity. Trials doesn't require a large area, only a few acres can be sufficient if the area has the right mix of terrain features. If designers have a suitable site, they could consider designating it for trials practice and events.

5. **Utilize manufactured design features.** In spite of all the tools available above, the reality is that there are many places that can't provide sustainable, quality technical challenge. Either they don't have the topography, features, or soils; or are too dry or too wet. Yet riders still want and need challenge, so how do designers provide that? It's time to think outside of the box and create it. By creating it, designers have the control to design what they want, where they want it. Management of the use, rider experience, and the resources can all benefit from that. The mountain bike community discovered this several years ago and has upped the challenge and fun factor with the development of coasters, ladder bridges, terrain parks, pump tracks, and freeride facilities. The OHV community could learn and benefit from these examples.

Other than site constraints and possibly funding, the ability to manufacture features is only limited by a person's level of vision and creativity. The opportunistic designer or manager keeps an eye out for free or low-cost material sources by staying in tune with other construction activities in the area that could have win-win potential: a road or building project that needs a waste site for dirt, stumps, logs, or rock; a building being demolished that could be a source for bricks or concrete chunks; a tire shop that needs to dispose of used or recalled tires; and the list goes on. Repurpos-

To provide more challenge opportunities in this project area, this designer imported material to create an ATV rock crawl. Cool!

Great innovative design. Take a flat trail on a ridgetop and dig alternating holes to create a "twister." It's fun, technical, and provides perceived exposure because your eye is pitched up and you cannot see where your tire is or how far down it will go.

It won't last forever, but the trees are more durable than the soil on this project and it made a great challenge feature that the riders enjoy.

A nearby highway project needed a waste area for rock and an OHV manager needed more 4WD challenge opportunities. A win-win deal was struck and a U-shaped rock garden was created. While only about 300 feet long, it can provide hours of seat time. Note the strategically placed winch tree(s) and signs for straps required.

Using old culverts and cement, this rock crawl adds difficulty by using the slope. A hillclimb without erosion. Neat.

The cement and rock structure has different levels of difficulty on each side to offer a 4WD rock crawl to various skill levels. It was simple to build and will last a long time.

ing materials destined for a landfill or other disposal facility helps the environment while helping designers provide for and manage the OHV use.

Liability often comes up in this discussion also, but again the mountain bikers have set the example for risk management by incorporating tools to limit liability, including entrance management, filters, effective signing, easy-outs, access control, design standards, and inspection and maintenance protocols.

What makes a great trail great? Variety. Use the ways outlined in this chapter to create variety and mix them up, but even then, do riders want to bounce over rocks and roots, squeeze between trees, hang on the edge of a cliff, or have poor flow for 20 miles? That type of trail isn't fun. To the extent that it's consistent with the TMO, challenge features should be intermixed with all of the other design tools that truly make a great trail great.

This entire trail was squeezed between trees so you had to stop or back up to get through. It was slow, you never got out of first gear, it had no flow, and the trail was no fun. The best part of the trail was the end of the trail.

There are plenty of creative options mentioned above to provide technically challenging experiences, but there are some things that shouldn't be done.

Don't:

- Reduce maintenance level, quality, or frequency. The degree of maintenance must agree with the TMO. Arbitrarily reducing maintenance can lead to tread degradation, erosion, resource impacts, rider safety concerns, and risk.

A well-intentioned, but misinformed maintenance worker deliberately cut out this tree to add more challenge to the trail.

Challenge? Not really. Agency risk? Yes.

This is a durable natural feature, but where is the line between challenge and risk? If an ATV is the design vehicle, utilizing this feature may have crossed it. This does not look that difficult, but poor soils or poor sight distance due to the alignment may have prevented getting a run at it.

- Reduce or remove drainage to increase challenge.
- Arbitrarily change the difficulty rating and signing without changing the TMO. The signing must agree with the TMO. If it doesn't, the agency is not managing its risk.
- Allow continued high-impact riding in natural areas not managed as open areas.
- Use unprotected wet area crossings that will develop into undesignated mud bogs.
- Design trails that will create unacceptable visual scars or be socially insupportable.
- Create a technical feature that is inconsistent with the TMO. This can trap riders, increase resource impacts, and increase agency risk.Remember that challenge is an expectation, risk is a surprise. Minimize the surprises.

Section 2: Using Existing Trails

Managers often ask, “Can I use exisitng trails?” The answer is the standard: “It depends.” A designated trail system is usually comprised of routes that come from three sources: 1) user-created trails that become incorporated into the system; 2) roads, trails, skid trails, seismic lines, or other routes that are repurposed as OHV trails; and 3) purpose-built trails that have been designed for a specific use or activity. The problem routes are usually those that were incorporated under the first two categories. Planners and designers should use these trails judiciously because although they have low up-front costs, they have inherent problems and risk that can result in high long-term operational costs.

This trail provides a high degree of challenge, but the other issues are obvious.

Four Components of Sustainability

There are four components to trail sustainability: 1) resource sustainability, 2) political or social sustainability, 3) experience sustainability, and 4) economic sustainability. These are powerful. If a trail does not have all four components, it could fail.

Resource sustainability. Will the trail provide resource protection in the long term? This is the definition that most people use when referring to sustainable trails.

Experience sustainability. The agency can have a resource sustainable trail, but what if the riders don’t like it? Will the trail provide the desired recreation experience in the long term? Will the experience stay at the same level in the long term?

Political or social sustainability. The agency can have a great trail that has both resource and experience sustainability but is in the wrong place and is unsupportable from a political or social standpoint. There could be visual impacts, noise impacts, or the social impact of “I don’t want to see that activity there.”

Managerial sustainability. There are several aspects of managerial sustainability. One aspect is economic sustainability. A trail in the wrong location can sometimes be mitigated by increasing maintenance and monitoring. But at some point, the cost of having the trail in that location may not be worth it. Another aspect is defensibility. Is the land manager in a position to be able to justify the trail in that location? Also are the skills of the maintenance and monitoring personnel suitable for the trail? Does the trail meet the needs of the riders?

A Case in Point…

When asked where there might be a place to have hillclimbs, the riders said: “Here, this is the perfect place for sustainable hillclimbs. They’ve been there forever and they’re the greatest.” They were right. There was durable soil, favorable climate, few ruts, almost no erosion, and high fun factor and challenge. Other than a visual scar, there were few adverse effects from years or decades of use. For all practical purposes, they had resource and experience sustainability.

Except those hillclimbs were located in a huge meadow that was determined to be a sensitive grassland environment; they were visible from a main recreation access road; they contributed noise impacts to residents; and they represented years of abuse and misuse to an intolerant community and media. They weren’t politically sustainable and today they are closed and rehabbed.

Erosion

Erosion is an ongoing process. It can be managed, but never stopped. Some of the best trail and technical challenge opportunities have been created through erosion, so erosion isn't necessarily bad. It depends on where it is occurring and its effect on other resources. If other resource values are low and there is no stream connectivity, the movement of soil particles from point A to point B is not loss, it's relocation. If the land manager feels comfortable with the effects, keeping the erosion may be an option. Given the same scenario with the same manager in a different location, the answer could be different.

At least with what we can see here, this great challenging trail can still be drained pretty easily by flowing in the direction of the blue arrow. If this is open to OHMs and ATVs, it would be nice to define at least one alternative path through the boulders.

In looking at a heavily eroded trail, it is easy for a designer to give up and say: "There is nothing to be done with this except close it." That may be true, but some type of drainage needs to be installed just to close and rehab the trail, so if that effort has to be made anyway, perhaps it's worth keeping the trail, or at least portions of it. Here are some management options:

- Close and rehab the trail.
- Relocate the trail.
- Keep the trail as is and allow the trail to continue to degrade.
- Keep the trail as is and take steps to reduce further degradation.
- Keep the trail as is and restrict or regulate the type and volume of use.
- Use a mixture of all of the above.

Each situation is unique, so designers should start with an assessment. An engineer, soil scientist, hydrologist, botanist, or other specialists may need to be part of the team. It's not a perfect world and creating great trails is about making informed decisions. Here are some key questions to ask when assessing a trail:

- Does the trail still provide a desired recreation experience? Is it a high-quality experience?
- The trail is eroded, but how much will it continue to erode and at what pace?
- Is the trail down to bedrock? Is the bulk of the damage already done?
- Can the erosion be managed? Where is the water coming from? Can that water be diverted into natural drainages?
- Is the trail on the fall line or in a natural drainageway?
- Can the trail be drained? With deeply entrenched trails, this could be difficult and expensive.
- Does the water from the trail have direct connectivity to a stream?
- Where are sediments carried by the water being deposited?
- What is the risk to resources if the trail is kept as it is?
- What is the risk to the resources if the trail is drained?
- Is the trail or the project in a fish bowl of controversy?
- Is the trail or the manager's decision politically and managerally sustainable?

This trail provides a high degree of challenge, but the banks are being eroded by overland flow. Some sloping and armoring of the banks would help, especially at major drain points. It would also help to remove some of the rocks and trees to reduce the weight on the edge of the bank.

This assessment and any resulting action decisions should be well documented.

Options to Consider

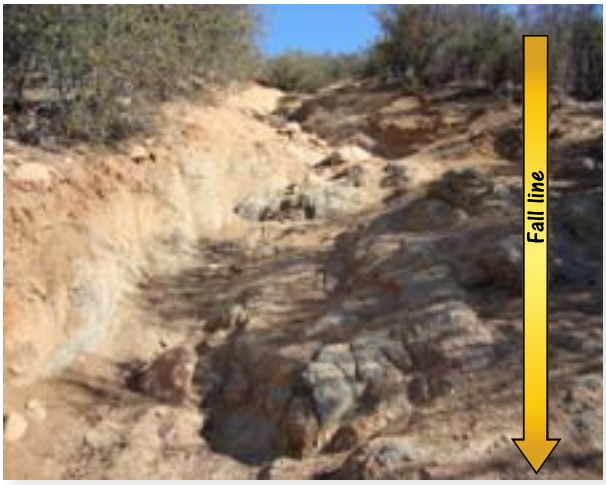
The answers to the above questions will determine the options for moving forward. Using a severely damaged existing trail is rarely the best choice, but in some cases, it may be the only choice. Heavily eroded trails essentially become stream channels by intercepting all of the water flowing overland from above. Correcting the water flow can be difficult and expensive, but not impossible. There are costs to implement these actions and costs to maintain them. Here are some things to consider:

The topsoil has eroded away, but what is left is a durable and challenging trail tread. At least in this trail segment, the erosion is either done or is manageable.

- Try to restore the natural drainageways. Water needs to flow down the landscape, not down the trail.
- In areas with heavy overland flow of water, diversion ditches could be installed above the trail to intercept this water and lead it into the natural drainageway. This will significantly reduce the size of the tread watershed and help protect the banks of the trail from further erosion. Most likely, the diversion ditches would need to be lined with rock to dissipate energy and prevent scouring of the ditch.
- If the banks of the trench are eroding heavily and diversion ditches are not installed, apply a blanket of rock to the banks to resist further scour.
- Construct rideable check dams. These would fill up the trench and essentially create a rock rolling dip. These could be used to either force water off the trail or slow the velocity of the water and drop its load of sediment. The check dam rock would need to be heavy and angular to resist displacement by tire action.
- Pop the trail out of the trench occasionally. This forces water off the trail and down the trench. Then construct a dam of dirt and rock and drain the trench into a natural drainageway. The trail can then re-enter the trench until the next drainage opportunity. This must be done at regular intervals so that the natural drainageways do not become overloaded with the trail runoff.
- Excavate the lower edge of the entrenched trail to create a ditch. Line it with rock and drain it wherever possible.
- Manage the trail by closing it during periods of high rainfall or saturated soils to reduce impacts.
- Reduce further displacement and erosion by armoring the tread. This keeps tire action away from the soil and reduces the velocity and scouring forces of the water running down the trail.
- Use the portions of the trail that can be drained and relocate the portions that can't.

Ruts contribute to challenge and so does this clay soil. To stabilize this, explore options to drain the water off before it gets to this slope (arrows).

Talk about a durable tread. This trail has eroded down to bedrock, but bank erosion will still occur. Look for opportunities to drain the water off or line the bank edges with rock.



There are few options to "fix" a fall line trail. This is a drainage and it always will be. If this is a small watershed, an option could be to divert water from this drainage into the next one if that doesn't overload the hydrology of the other drainage, then use this trail as is. Other options could be: close and relocate; or continue to use the trail as is if it is meeting the TMO.

Though entrenched, this trail runs across the slope and there may still be opportunities to punch through the bank on the lower side to drain it.

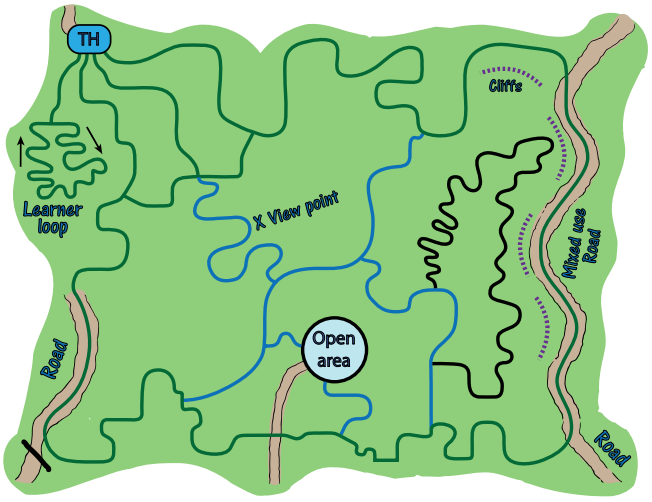
There could be an opportunity here to pitch up out of the trench and force the water to drain down to the left.

Some soils scour very easily once water volume and velocity reach a critical point. Once started, the scour accelerates to create a ravine. Potential remedy: Find a point to drain the trench, then fill it up with cobble rock. Install an armored rolling dip (arrow). Find the source of all of this water and drain it off farther up the trail.

How steep is too steep? This isn't that steep, but it's too steep for these soils in this climate. Add in too long and too straight and you get a trench. This needs to be analyzed, but now that it's eroded, the residual grade may be sustainable. If not, trail hardening armoring would help. Look at draining water off above and below this section.

Section 3: A Different Approach to Challenge

So far, this chapter has discussed incorporating natural and manufactured features and designing for challenge. After designers have incorporated those features, they normally label the trail with a blue square (More Difficult), black diamond (Most Difficult), or double black diamond (Extremely Difficult). In reality though, only a percentage of the trail actually contains those challenge features, yet the whole trail is labeled to reflect the worst condition. In many cases, a black trail isn't all black, it's blue with a few black spots. Granted, there are those trails that are gnarly from start to finish and those should be labeled accordingly, but what about those that aren't consistently gnarly?



Here is a traditional trail plan with Green, Blue, and Black trails

Designers can install filters so that only riders with the proper skills can access a trail, but if only 20 percent of the trail is gnarly, there is 80 percent that could still be ridden by lesser skilled riders, but those riders can't access it. Is that the best utilization of a trail resource?

If designers don't install filters, what generally happens with the challenge features? The lesser skilled riders start looking for a way around the challenges. These are called easy-outs. Why this occurs relates directly back to the riders' feelings about safety and efficiency. The easiest and most comfortable line may not be the straight line. This can result in braided trails and resource impacts.


As with many challenge features, the less skilled or less comfortable riders start looking for a way around them.

There are three remedies for the problem of unskilled riders ruining or breaching technical features: design easy-outs, design technical options, or design with multiple lines.

Design Easy-Outs

If the tendency is to ride around a feature, why not design the feature with an easy-out so the trail team can control and manage the use? If all of the technical features on a trail had easy-outs, the overall difficulty rating may be lower and more riders of varied skills could utilize the trail. Easy-outs don't have to be easy, they just need to be easier than the challenge feature.

Here is another consideration: maintenance. If equipment is going to be maintaining the trail, how does it get over a challenge feature without damaging it? An easy-out can provide a bypass for the maintenance equipment as well as the riders.

Design Technical Options

Even better than designing easy-outs is to design the entire trail as green or blue with technical outs where the riders have a choice of staying on a less technical route or riding a more technical section. The technical sections can be very short to take advantage of a boulder feature, or longer for a rock garden, but they all loop back to the main trail. If the trail was a double track, there could be both single-track and double-track technical options. Here are some advantages of

designing technical options rather than a technical trail.

- More riders can use the entire trail. In areas where trail development is limited, this could be a significant advantage.
- Better utilization of the land base because one trail can offer several challenge levels.
- A group of riders of varied skill levels can ride together. This extends time for camaraderie, bonding, social interaction, and it's especially good for families.
- Riders can choose the amount of challenge they are comfortable with on any given day or time; and it may depend on the make-up of the group.
- Less risk of resource impacts due to the creation of easy-outs because the main trail is the easy-out.
- Fewer tread impacts caused by under-skilled riders attempting higher-skilled features. This equates to less maintenance.
- Options, like an easy-out, could allow a bypass for maintenance equipment so the more technical lines do not get damaged.
- Better utilization of available features.
- With the lack of available natural features, manufactured features can be incorporated adjacent to the main trail.
- Higher fun factor and increased rider satisfaction.

This is a great example of designing a feature with an easy out.

This rock step-up feature was the only technical area in this trail loop. Riders began to form an easy-out to the left of the area. A better solution would be to create a designed easy-out around the rock feature.

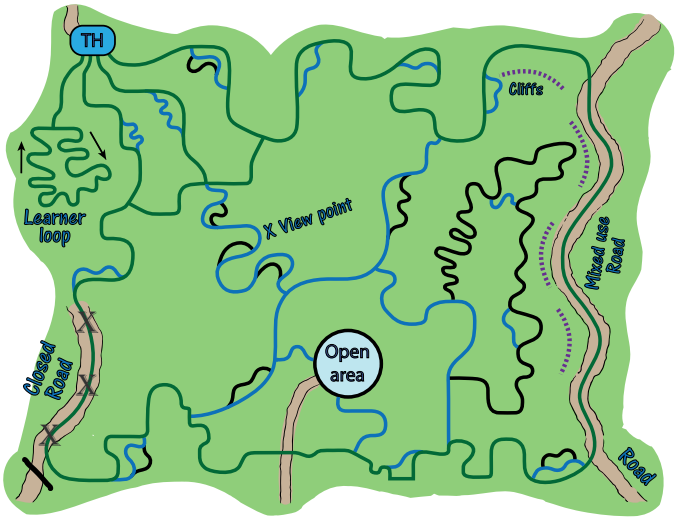
This was an error in planning and design. This is a nice hillclimb with durable soils and a great rock step-up near the top. For this reason, the trail was rated as Most Difficult, but the trail leading up to this feature was not difficult and the lack of entrance management lured under-skilled riders into the feature with no way around it, so braiding started to occur. Also, the trail on each side of this needed machine maintenance, so it wasn't long before the dozer found an easy way down the slope and of course the riders soon followed. This feature should have been initially designed with an easy-out so the agency could have controlled its location and better managed the operational use.

Design with Multiple Lines

Another technique from the mountain bikers is designing features with multiple approach lines, so one feature can offer several different challenge experiences depending on the riders' feelings of safety and efficiency on a given day. Providing challenge features with choices increases the fun factor and decreases tread impacts. Of course, not all features can have multiple lines, but this is a great technique that should be incorporated wherever possible by the innovative designer. Again, an advantage of multiple lines is that one of them could allow a bypass for maintenance equipment so the more technical lines do not get damaged.

It's short, but it takes advantage of a challenge feature without affecting the challenge level of the main trail.

The riders have a choice; smooth or rough. Signing is essential for rider information and risk management.



The same trail plan with technical options has far more diversity.

This rider actually had a choice of four lines over these boulders. It is far more fun to have a choice than be locked into just one line.

This was manufactured to provide a choice of at least three approach lines.

Climbing up this slab rock, riders will have an option of several lines and challenge levels.

A Look Back...

Here are some of the elements discussed in this chapter:

- A common dilemma is how to provide challenge and still maintain sustainability
- There are five main tools to help solve this dilemma:
  - Utilize natural features
  - Utilize design features
  - Utilize manufactured topographic features
  - Utilize natural topographic features
  - Utilize manufactured design features (man-made features)
- Maintain a variety of features and experiences. 100% gnarly is 0% fun.
- In order to protect resources, be consistent with the TMO, and manage risk; there are several things that should not be done when providing challenge
- There are four aspects to sustainability: resource, political or social, experience, and managerial. Without all four, a trail or project could fail.
- Erosion can be managed but not be stopped, and it can create challenging trail features
- In dealing with existing impacts, management has several options depending on resource values and political sustainability:
  - Close and rehab
  - Relocate
  - Keep the trail as is and allow the trail to continue to degrade
  - Keep the trail as is and take steps to reduce further degradation
  - Keep the trail as is and restrict or regulate the use
  - Use a mix of all of the above
- Taking a different approach to challenge can have many benefits, including better utilization of the trail resource
- Challenge feature easy-outs help protect resources while better managing the OHV use and providing a bypass for maintenance equipment
- Designing the trails with technical options gives the riders a choice of challenge based on their feelings of safety and efficiency on a given day. This allows for green, blue, and black challenge levels all on the same trail.
- Designing a challenge feature with multiple approach lines is a creative way to provide riders with choices, which can enhance their experience