Infrastructure can be defined as the essential facilities and services upon which the economic productivity of society depends. These assets are typically involved in the movement of goods, people, water, and energy, and include:

- Regulated assets, including electricity transmission lines, gas and oil pipelines, water distribution systems, and wastewater collection and processing systems
- Transportation assets, including toll roads, bridges, tunnels, railroads, rapid transit links, seaports, and airports
- Communications assets, including radio and television broadcast towers, wireless communications towers, cable systems, and satellite networks
- Social infrastructure assets, including schools, hospitals, prisons, and courthouses

Historically, existing, core infrastructure assets in developed geographies (the lower end of the risk spectrum) have offered equity investors low double digit returns with the majority of that return coming from cash yield and the rest from capital appreciation.

Exhibit 1: Illustrative infrastructure returns

The following illustrative returns and yields are based on historical data prior to July 2008. Given the changing market environment, we expect that a new equilibrium will be reached and expected returns will be higher.

<table>
<thead>
<tr>
<th>Asset segment</th>
<th>Risk</th>
<th>Avg. cash yield % (years 1–5)</th>
<th>Avg. leveraged IRR (%)</th>
<th>Capital appreciation potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private Finance Initiatives (PFI)</td>
<td>Low – Medium</td>
<td>4-5</td>
<td>6-9</td>
<td>Extremely Limited</td>
</tr>
<tr>
<td>Toll roads (Operating)</td>
<td>Low – Medium</td>
<td>4-6</td>
<td>8-12</td>
<td>Limited</td>
</tr>
<tr>
<td>Contracted power generation</td>
<td>Low – Medium</td>
<td>4-7</td>
<td>10-13</td>
<td>Limited</td>
</tr>
<tr>
<td>Regulated assets</td>
<td>Low – Medium</td>
<td>5-8</td>
<td>10-15</td>
<td>Limited</td>
</tr>
<tr>
<td>Rail</td>
<td>Medium</td>
<td>8-12</td>
<td>14-18</td>
<td>Yes</td>
</tr>
<tr>
<td>Airports/Seaports</td>
<td>Medium</td>
<td>4-7</td>
<td>14-18</td>
<td>Yes</td>
</tr>
<tr>
<td>Toll roads (Development)</td>
<td>Medium – High</td>
<td>3-5</td>
<td>12-20</td>
<td>Yes</td>
</tr>
<tr>
<td>Communications networks</td>
<td>Medium – High</td>
<td>4-7</td>
<td>15-20</td>
<td>Yes</td>
</tr>
<tr>
<td>Merchant power generation</td>
<td>High</td>
<td>4-12</td>
<td>15-25</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Source: J.P. Morgan Asset Management

There is a current and growing global need for governmental bodies to finance, maintain, modernize, expand and develop infrastructure facilities essential to ensuring continued growth in economic activity and productivity. It is estimated that $16 trillion will be required to modernize and expand water, electricity and transportation systems in the U.S., Canada and Western Europe over the next 25 years. With governments increasingly hard-pressed to obtain the capital required to maintain and expand their infrastructure, they have begun to recognize that private sector capital can be used to satisfy those infrastructure needs, allowing them to focus existing limited resources toward other vital functions within their communities. These trends present a significant opportunity for investors to acquire and manage high-quality assets around the world.

Investors are increasingly considering infrastructure as an attractive investment alternative primarily because these assets can provide portfolio diversification with the potential for stable cash yields. In the current market environment, the demand for core plus private infrastructure has been particularly strong because these investments seek to offer long-term exposure to relatively stable, economically insensitive, inflation protected cash flows. These assets have the potential to generate low volatility, consistent growth of cash flows and returns that are uncorrelated with other asset classes, resulting in very attractive diversification benefits for investors. This paper summarizes the key benefits and risks of investing in infrastructure.

Infrastructure assets have several unique characteristics that make them attractive investments. Here are some potential benefits:

- **Stable cash flows and economic insensitivity**: Because most infrastructure assets have monopolistic positions in and provide essential services to the markets they serve, demand is often very stable. For those assets, usage does not materially decline with price increases or during periods of economic weakness.

- **Diversification benefits**: As a result of low usage volatility, economic insensitivity, and inflation-protection characteristics, a portfolio of infrastructure assets has low correlation to other major asset classes resulting in compelling diversification benefits.

- **Attractive long-term returns**: The services provided by infrastructure assets are essential for the functioning of a society. While not allowing infrastructure assets to charge monopoly prices, governments must allow private owners to earn fair returns in order to incentivize them to keep facilities in good working order, and invest for future growth and modernization.

- **Inflation protection**: Rates charged by infrastructure assets are determined by regulators, concession agreements with governments, and long-term contracts. Owners generally have the ability to increase rates at some level linked to inflation and/or the economy over time.

Concurrently, while they can be mitigated, there are several key risks of infrastructure investing:

- **Sub-sector**: Each infrastructure sub-sector has different risk factors, return drivers, and economic sensitivities. Due to low correlation among sub-sectors, these risks can be reduced by constructing a well diversified infrastructure portfolio.

- **Political and regulatory**: Different countries/regions have different political, regulatory and legal frameworks. Especially in jurisdictions with relatively shorter regulatory histories, regulatory decisions may be inconsistent, increasing uncertainty for investors. Investing in politically stable regions with established legal and regulatory frameworks can reduce these risks.

- **Stage of development**: Development projects face higher construction risks and demand uncertainty compared to mature assets. Investors can choose to avoid these risks by investing only in existing infrastructure. Those willing to take these added risks may be compensated with higher returns.

- **Liquidity**: Due to the size of some assets, the limited number of potential buyers and regulatory approval requirements, divestments of infrastructure assets can take a significant amount of time and effort. An open-ended fund provides a long-term investment approach that will not force asset sales and may provide added liquidity relative to closed end funds.

- **Emerging asset class**: As a relatively new asset class, infrastructure does not have reliable return data comparable to other asset classes which makes it difficult to model in an asset allocation. Using historical cash flows to model returns is one method we will discuss that allows investors to make a more informed allocation decision.

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4 This paper focuses on core-plus, developed market infrastructure investments with an emphasis on open-ended vehicles. JPMAM Global Real Assets believes that other investment vehicles are appropriate for more opportunistic strategies, such as development projects and non-OECD infrastructure, which may be suitable for investors interested in a higher risk/return profile. Please refer to the JPMAM research piece “Greenfield Infrastructure Assets.”
**Benefits of infrastructure investing**

**Provision of essential services with little or no competition results in inelastic demand**

Infrastructure assets supply essential services and, as a result, demonstrate a usage pattern similar to other non-discretionary consumer goods. Since these assets provide essential services, and rates that are charged for these services are affordable and are set at levels below monopoly prices, usage does not significantly decrease during periods of economic weakness or when rates are increased. Exhibit 2 shows the steady increase in electricity usage since 1974 regardless of the economic environment or price of electricity. The estimated price elasticity for residential electricity consumption is –0.05 (i.e., a 20% increase in price leads to a 1% decline in consumption).

Similarly, the demand for natural gas is not highly correlated to the price of the underlying commodity. As demonstrated in Exhibit 3 (following page), the demand for natural gas is driven by temperature; it is not dependent on the economy or on the price of the underlying commodity. The correlation coefficient between heating degree days (or HDD—which serve as a proxy for cold weather) and the monthly residential natural gas consumption in the U.S. is 0.86.

**Infrastructure assets can provide diversification benefits**

As a result of low usage volatility, economic insensitivity, and inflation-protection characteristics, a portfolio of infrastructure assets has low correlation to other major asset classes resulting in attractive diversification benefits. Historical return data for a broad set of infrastructure assets does not exist, particularly in the U.S. where toll roads, bridges, airports and seaports are largely owned by the government or quasi-government agencies and have, until recently, rarely been bought and sold on the open market. As a result, in a recent analysis, we examined historical cash flows of 256 core assets providing stable cash flows present opportunities to boost return on equity via leverage at the operating company level. Credit market conditions impact the amount, cost and terms of credit available to infrastructure assets. Managers can mitigate this risk by making conservative refinancing assumptions when underwriting and employing leverage prudently, in quantity, structure and tenor.

**Currency volatility**

A global infrastructure investment strategy provides diversification benefits to moderate several risks (e.g., political, regulatory, demographic) but does expose an investor to the currency volatility of the underlying portfolio companies. Investors can hedge this with a currency overlay strategy.

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Appendix A.
infrastructure assets and determined that infrastructure cash flows are not highly correlated to those of equities and real estate, as shown in Exhibit 4.

Exhibit 4: Correlation coefficients between infrastructure, corporate and real estate cash flows 1986–2006

<table>
<thead>
<tr>
<th></th>
<th>Real Estate NOI</th>
<th>Corporate EBITDA</th>
<th>Infrastructure EBITDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real Estate NOI</td>
<td>1.0</td>
<td>-0.17</td>
<td>0.31</td>
</tr>
<tr>
<td>Corporate EBITDA</td>
<td>-0.17</td>
<td>1.0</td>
<td>0.31</td>
</tr>
<tr>
<td>Infrastructure EBITDA</td>
<td>0.31</td>
<td>0.31</td>
<td>1.0</td>
</tr>
</tbody>
</table>

* Correlation coefficients are based on annual data

Source: J.P. Morgan Asset Management. Exhibits 4 and 5 are shown for illustrative purposes only. The information shown is based on proprietary internal analysis. No guarantee is being made that the figures above are representative of expected future results.

In order to provide investors with a viable way of analyzing infrastructure performance so that informed asset allocation decisions can be made, historical cash flows were used as the primary factor to determine hypothetical historical returns. Those returns have had very low correlations to the returns of other asset classes over the last ten years and may therefore significantly improve portfolio diversification and risk-adjusted returns.

Exhibit 5: Correlation coefficients of 10-year returns

<table>
<thead>
<tr>
<th></th>
<th>U.S. Treasuries</th>
<th>U.S. Large Cap</th>
<th>EM Equities</th>
<th>Direct Real Estate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure EBITDA</td>
<td>0.19</td>
<td>0.04</td>
<td>0.06</td>
<td>0.23</td>
</tr>
</tbody>
</table>

Source: J.P. Morgan Asset Management. The above table is shown for illustrative purposes only.

Governments and regulators allow fair returns in order to entice private capital to invest in infrastructure

Infrastructure assets provide services that are essential for economic activity and a basic standard of living in modern society. Without the services supplied by infrastructure assets, ranging from water and sewerage systems to electricity and airports, a modern economy could not function. For that reason, governments are increasingly focused on ensuring that infrastructure assets are available, in good condition and are consistently reliable. The causality between the availability of infrastructure services and economic productivity is well-established, and governments across the developing world make provision of infrastructure a high priority. In the developed world, as observed in the California electricity crisis of 2000 and 2001, the Paddington train crash of 1999 in the U.K., and more recently in the Minnesota bridge collapse in 2007, any stoppage or malfunction of infrastructure services rightly results in public concern and outcry. Booz Allen Hamilton estimated that $40 trillion is needed over the next 22 years to replace the aging infrastructure required to accommodate growing and underserved populations. Many governments are not in a fiscal position to meet this spending need. Budget constraints continue to worsen. Tax receipts are falling due to the faltering economy and the ability to issue debt is becoming more difficult due to credit market conditions and debt ceilings. As a result, governments are becoming more willing to involve private capital in the process and allow private capital to earn a fair return that will incentivize the
required infrastructure investment. Further, governments are working to implement best practices in their regulatory institutions, ranging from transparency to predictability. Lowering the regulatory risk for private investors lowers the risk premium, reducing costs and creating long-term benefits for the end-users through lower rates and tariffs.

Most infrastructure assets are natural monopolies—assets with relatively high fixed costs, and low variable costs. By definition, a natural monopoly exists when one provider can serve that market at a lower cost than multiple providers. For example, it does not make economic sense to construct a second set of electric cables, or water or gas pipes to serve one neighborhood. Similarly, a second highway, airport, or even a power generation plant is economical only if the existing asset is capacity-constrained. Since infrastructure assets are providing essential services, regulators ensure that the owners do not charge monopoly prices to the end-users, but rather that owners are compensated sufficiently to maintain the assets and provide reliable service, while keeping the costs to end-users at affordable levels.

Infrastructure assets can provide protection against inflation

Whether they are determined by the regulators, concession agreements, or long-term contracts, the rates that are charged for usage of infrastructure assets are usually linked to inflation in the long run. Specifically, revenues of infrastructure assets are determined by:

- **Regulators:** Regulated electricity, natural gas, and water and sewerage utilities have periodic “rate cases” where regulators determine the allowed return on equity based on the necessary capital and maintenance expenditures. All of the variable costs, such as the cost of wholesale natural gas or electricity, are passed through to end-users.

- **Concession agreements:** Mainly used for public-private partnerships in the transportation sector, concession agreements define the upper limits on rate or toll increases that the concessionaire can charge. The rate increases are usually linked to inflation, and in the case of deferred maintenance of a previously publicly-owned asset, allow for the recovery of maintenance costs.

- **Long-term contracts:** Regulated electricity utilities have mandates to provide long-term resource plans to the regulators, based on reliability and minimum-cost characteristics. Qualifying power generators, especially generators that produce energy from clean sources, usually have 20+ year contracts where payments depend on availability and can be indexed to inflation.

To demonstrate this inflation-protection characteristic, we analyzed how the annual cash flows (measured by EBITDA) of 256 mature infrastructure assets in the U.S. and EU-15 performed from 1986-2006. Cash flows grew steadily, at a rate above inflation (as measured by the Consumer Price Index) regardless of the global economic environment.\(^9\)

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Key risks

Sub-sector risk

Each infrastructure sub-sector has unique risks. Sub-sectors are regulated by different governing bodies. They have varied economic sensitivities (e.g., a seaport is more dependent on trade and economic activity than residential water usage) and varied dependencies on the availability of natural resources. As one would suspect, bridge or air traffic has a very low correlation to residential electricity or water consumption.

As shown in Exhibit 7, correlations among sub-sectors are relatively low, so much of this sub-sector risk can be mitigated by creating a well-diversified infrastructure portfolio.

Political and regulatory risk

As previously mentioned, infrastructure assets are essential for the functioning of a society, and hence governments continuously monitor and regulate them. The regulatory environment can vary significantly from one authority to another, so managers must have a strong understanding of political developments and experience in assessing regulatory risk. Regulated utilities can have unfavorable rate cases where regulators may reduce the returns on equity without any justification. In some extreme cases, especially in jurisdictions where the rule of law is not well-established, regulators can claim underperformance and try to re-possess an asset.

Investors can mitigate this risk through the decision of where to invest. This decision requires a keen understanding of various geographies, political, regulatory and legal environments. Additionally, a manager’s investment strategy and relationship with the regulators can help reduce this risk. All else being equal, government regulators view long-term investors more favorably than investors who have short-term holding periods (i.e., closed-end fund structures) and are trying to maximize profits in the short-run, potentially to the detriment of end-users.

Greenfield investments

The history of greenfield infrastructure investing is rich with examples of underperformance as a result of cost overruns, completion delays, usage shortfalls, longer than expected demand ramp-up periods, etc. However, there are also examples of greenfield projects succeeding beyond the initial expectations, or because the risks of start-up and ramp-up were mitigated by appropriately allocating them to parties best suited to manage such risks. There are basically two types of risks involved in greenfield infrastructure investing: (i) the completion risk, due to construction delays, cost overruns, or bureaucratic red-tape; and (ii) the usage risk, due to insufficient demand for the service that the infrastructure asset will provide once it is built.

Investors can largely avoid greenfield investment risks by investing only in mature assets with stable operating histories or funds that are focused on development only to the extent that it involves replacing an existing asset. If an investor wants greenfield exposure, there are often ways to mitigate the associated risks. Experience shows that completion risk can be mitigated by aligning the interests of involved parties and carefully crafting concession agreements or public-private partnerships. Usage risk, on the other hand, depends on the nature of the project, the existence of close substitutes, and preferences and habits of potential end-users. Comprehensive research and economic analysis can be used to help understand and mitigate those risks faced by each individual project. However, each infrastructure asset is unique, and inference based on experience in comparable situations can result in a relatively high margin of error.

Liquidity

Infrastructure investments can be less liquid than many other assets and are best suited for a long-term investment strategy. Individual infrastructure assets are usually larger in value than real estate assets and have a smaller universe of potential buyers. Because of the extensive due diligence effort and

<table>
<thead>
<tr>
<th>Exhibit 7: Correlation coefficients of annual cash flow growth rates of U.S. infrastructure sub-sectors, 1986 to 2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric companies</td>
</tr>
<tr>
<td>Electric companies</td>
</tr>
<tr>
<td>Gas companies</td>
</tr>
<tr>
<td>Water and wastewater</td>
</tr>
<tr>
<td>Toll roads</td>
</tr>
<tr>
<td>Airports</td>
</tr>
<tr>
<td>Seaports</td>
</tr>
</tbody>
</table>

Source: J.P. Morgan Asset Management. The above table is shown for illustrative purposes only.
regulatory approval these assets typically require, divestiture of an infrastructure asset may take a considerable amount of time and substantial resources.

Investors can gain exposure to infrastructure assets through a number of vehicles with varying liquidity terms. Open-ended funds generally take a very long-term investment approach and will not be forced to divest an asset simply because the fund may be nearing the end of its term. Open-ended funds which offer redemption privileges may provide investors more liquid exposure to infrastructure relative to closed-end funds.

An emerging investment strategy

Infrastructure is a relatively new asset class. Even in the developed world, there is limited available data on its historical performance. Investors trying to make portfolio allocation decisions cannot easily compare and rank infrastructure assets against other investment alternatives. One option for investors is to develop informed estimates of the financial performance. Given that rates are determined by regulated returns and long-term contracts, estimation of usage patterns becomes essential in this method. Another alternative is to use existing (but still limited) Australian, listed-equity data and examine the relationship of infrastructure investments with other asset classes in those markets.10 Finally, as previously discussed, investors can use historical cash flows to model historical returns for allocation purposes.11

Credit markets

The cash flow potential of infrastructure assets may present opportunities to boost return on equity via leverage at the operating company level. Credit market conditions impact the amount, cost and terms of credit available to infrastructure assets. Managers can mitigate this risk by making conservative refinancing assumptions when underwriting, and employing leverage prudently—in quantity, structure and tenor.

We believe that the defining attributes of infrastructure assets make this asset class relatively well-positioned to weather a turbulent credit market environment. Core infrastructure assets have generated low volatility and steadily growing cash flows regardless of economic conditions, making infrastructure loans much less risky than most other types of loans.

Currency volatility

While diversification of infrastructure investments across countries generally provides benefits to a portfolio, such an approach also adds exchange rate volatility to returns. Exchange rates, especially between currencies of similarly-developed countries, generally revert to the mean in the long run, so for long-term investors in core and core-plus investments, short-term exchange rate fluctuations have less importance. Depending on availability of information, it is often possible for investors to cost-effectively hedge this exposure with a currency overlay. Additionally, investing in a fund with explicit diversification guidelines limiting over-concentration to specific geographies can help to lessen these risks.

Conclusion

In today’s extremely volatile markets, investors are increasingly considering allocations to infrastructure. These assets generally have monopolistic positions and provide essential services in the areas in which they operate. As a result, demand for these services is relatively insensitive to economic weakness and price increases. Additionally, regulators usually allow private owners of infrastructure to earn fair real returns in order to incentivize them to provide adequate service to the public—regardless of the economic or inflationary environment. Infrastructure assets have produced stable, predictable and growing returns that in some cases have provided an inflation hedge by being linked to price levels via either a regulated return framework or a contracted rate of return.

The low volatility of demand and inherent inflation protection characteristics of infrastructure assets result in their low correlation to other major asset classes. These assets provide investors with an attractive diversification opportunity and the possibility to materially improve a portfolio’s risk-adjusted return. Demand for infrastructure assets has increased, particularly with institutional investors, because they are a good match for defined-benefit pension liabilities, endowment and foundation obligations, and annuity and life insurance liabilities.

There are several risks in infrastructure investing, but as discussed, they can be mitigated by investors and managers. Infrastructure managers must have expertise in a variety of sub-sectors and regions with intimate knowledge of various regulatory frameworks in order to successfully underwrite and to later manage these assets. Additionally, the type of vehicle (we advocate the perpetual, open-end structure) through which investors gain exposure to infrastructure, can serve to mitigate liquidity and capital market risks while offering investors exposure to this attractive asset class.

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Appendix


Annual volatilities based on monthly data

- Equities
- Non-discretionary consumption (USD)
- Infrastructure usage (units)


Opinions, estimates, forecasts, and statements of financial market trends that are based on current market conditions constitute our judgment and are subject to change without notice. We believe the information provided here is reliable but should not be assumed to be accurate or complete. The views and strategies described may not be suitable for all investors. References to specific securities, asset classes and financial markets are for illustrative purposes only and are not intended to be, and should not be interpreted as, recommendations. Indices do not include fees or operating expenses and are not available for actual investment. The information contained herein employs proprietary projections of expected returns as well as estimates of their future volatility. The relative relationships and forecasts contained herein are based upon proprietary research and are developed through analysis of historical data and capital markets theory. These estimates have certain inherent limitations, and unlike an actual performance record, they do not reflect actual trading, liquidity constraints, fees or other costs. References to future net returns are not promises or even estimates of actual returns a client portfolio may achieve. Certain information contained in this white paper constitutes “forward-looking statements,” which can be identified by the use of forward-looking terminology such as “may,” “will,” “should,” “expect,” “anticipate,” “project,” “estimate,” “intend,” “continue,” or “believe,” or the negatives thereof or other variations thereon or comparable terminology. Due to various risks and uncertainties, actual events or results or the actual performance of an infrastructure investment may differ materially from those reflected or contemplated in such forward-looking statements.

RISKS: Investing in infrastructure assets may be subject to a variety of risks, not all of which can be foreseen or quantified, including operating, economic, environmental, commercial, currency, regulatory, political and financial risks. There is no assurance that the investments will be profitable or generate cash flow sufficient to provide a return. An investment in an infrastructure fund is subject to certain risks related with the ownership of infrastructure and infrastructure-related assets in general, including: local, national and international economic conditions; the supply and demand for services from and access to infrastructure. Although infrastructure investment may generate some current income, they are expected to be generally illiquid. In addition, public sentiment and political pressures may affect the ability of a fund to sell one or more of its infrastructure assets. As a result, it may be difficult from time to time for the fund to realize, sell or dispose of an asset at an attractive price or at an appropriate or in response to changing market condition.

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