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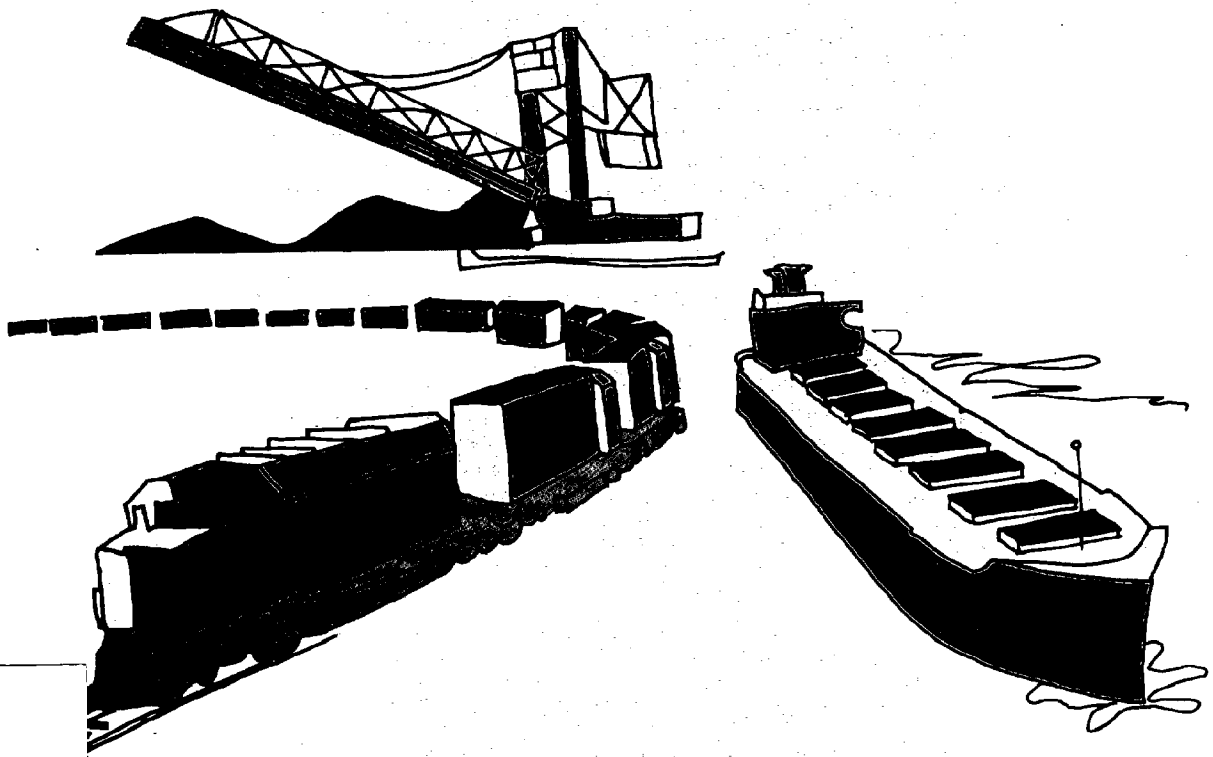
Coal Export Facility Development in Washington

An Analysis of Potential Environmental Impact Issues

Washington
Public Ports Association



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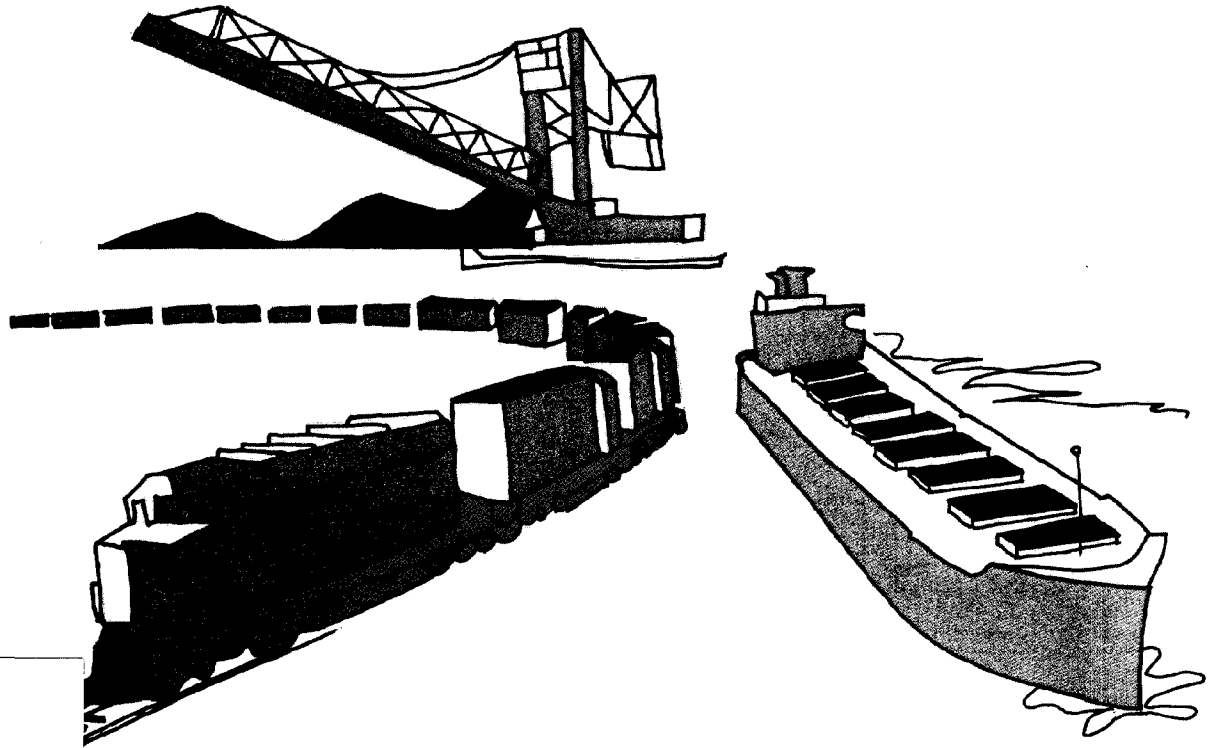

KCM

Coal Export Facility Development in Washington
An Analysis of Potential Evironmental Impact Issues

A summary prepared by
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for the
Washington Public Ports Association

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Study Scope

This summary presents the results of a study sponsored by the Washington Public Ports Association (WPPA) to define and analyze critical environmental impact issues associated with the proposed development of coal export facilities in the state of Washington. Kramer, Chin & Mayo, Inc. (KCM) conducted this study in association with Reid, Middleton and Associates, Inc. (RMA) and Williams-Kuebelbeck and Associates, Inc. (WKA).

Study activities involved a coordinated research effort aimed at characterizing: (1) the level of coal export activity likely to occur in the state by the year 2000; (2) major transportational issues associated with these coal export activities; (3) export facility site requirements; (4) environmental impacts and issues associated with export facility development; and (5) potential impact avoidance measures.

The results have been published in a 100-page final report which is available through the WPPA. This summary supplies an introduction to the major results and conclusions of that larger report.

The major findings of this research effort were:

1. **Substantial coal exports from Washington state ports can be expected by the year 2000 because the foreign demand for this energy source is increasing.**
2. **Increased exports will require new port facility development as well as highly specialized equipment for coal transshipment.**
3. **Any site where coal exporting facilities are located will experience attendant environmental impacts.**
4. **Specific cost-effective impact avoidance measures can be implemented to minimize damage to the environment.**

Background

The dwindling long-range prospects for any substantial increase in the supply of oil at acceptable prices is a major reason for increased interest in coal. Even with optimistic forecasting for the expansion of nuclear power and the aggressive development of all other energy sources, as well as vigorous conservation, coal clearly has a vitally important part to play in the world's energy future.

The 1982 *Western Coal Export Task Force—Pacific Basin Steam Coal Export Study* (the WESTPO Study) predicts that coal consumption by the Pacific rim nations of Japan, South Korea and Taiwan will total close to 60 million tons by 1985. By 1990, western U.S. coal may comprise as much as one-quarter of approximately 100 million tons of far east coal demand.

Development of coal export facilities in Washington state will contribute to a larger national goal and also will fill the need for an increased coal export capacity. The U.S. still has large coal reserves, particularly in the western states. Coal port development promotes the national goal of shifting the global energy economy away from the petroleum-producing nations and

Export Activity: Potential Market Share and Facility Capacity

toward the U.S. and its resources.

Direct benefits to the state will come in the form of broadened local tax bases and increased local revenues in the communities where coal ports are developed. Anywhere from 30 to 130 direct jobs will be created at each facility, and probably twice that number of secondary or support industry opportunities will be created.

No direct method for collecting state revenues on coal exports currently exists. Specific mechanisms to this end have yet to be formulated.

The primary market for western U.S. steam coal is the Pacific rim nations of Japan, Korea, Taiwan, Indonesia, Hong Kong and the Philippines. These and other Asian countries are expected to steadily increase their demand for coal through the year 2000 as they seek to replace petroleum for electrical generation and other uses. This increase in Pacific rim steam coal demand is outlined in Table 1.

To satisfy this demand Asian countries will seek to secure coal sources in Australia, Canada, China and the U.S. to avoid an excessive dependence on supply by a single source. The western U.S. market share of total far east coal demand is anticipated to be approximately 14 percent in 1985, increasing to 20 percent by the year 2000.

Pacific northwest ports (all Washington state ports and Columbia River ports in Oregon and Washington) are expected to handle 40 percent of all U.S. west coast coal exports in 1985, increasing to approximately 70 percent of all exports in the year 2000. Specific coal export forecasts in millions of tons are listed in Table 2.

In order to handle 30 million tons of coal for export in the year 2000, the Pacific northwest will need two or three coal port facilities. Where those ports are located will depend on many factors, including the international customers who are buying the coal and what long-term contracts have been arranged. The exact number and size of the coal exporting facilities will depend on those factors and the sites where they are located.

TABLE 1

Pacific Rim Coal Demand

Year	Approximate Total Demand (millions of tons)
1985	55
1990	105
1995	150
2000	208

Source: WESTPO Study, 1982.

TABLE 2

Forecasts of Western United States Steam Coal Exports (in millions of tons)

Year	Total U.S. West Coast Exports	Pacific Northwest Market Share
present	5.0	0.0
1985	7.5	3.0
1990	18.5	9.0
1995	30.0	18.0
2000	41.5	30.0

Source: Williams-Kuebelbeck & Associates, Inc.

Industry Requirements

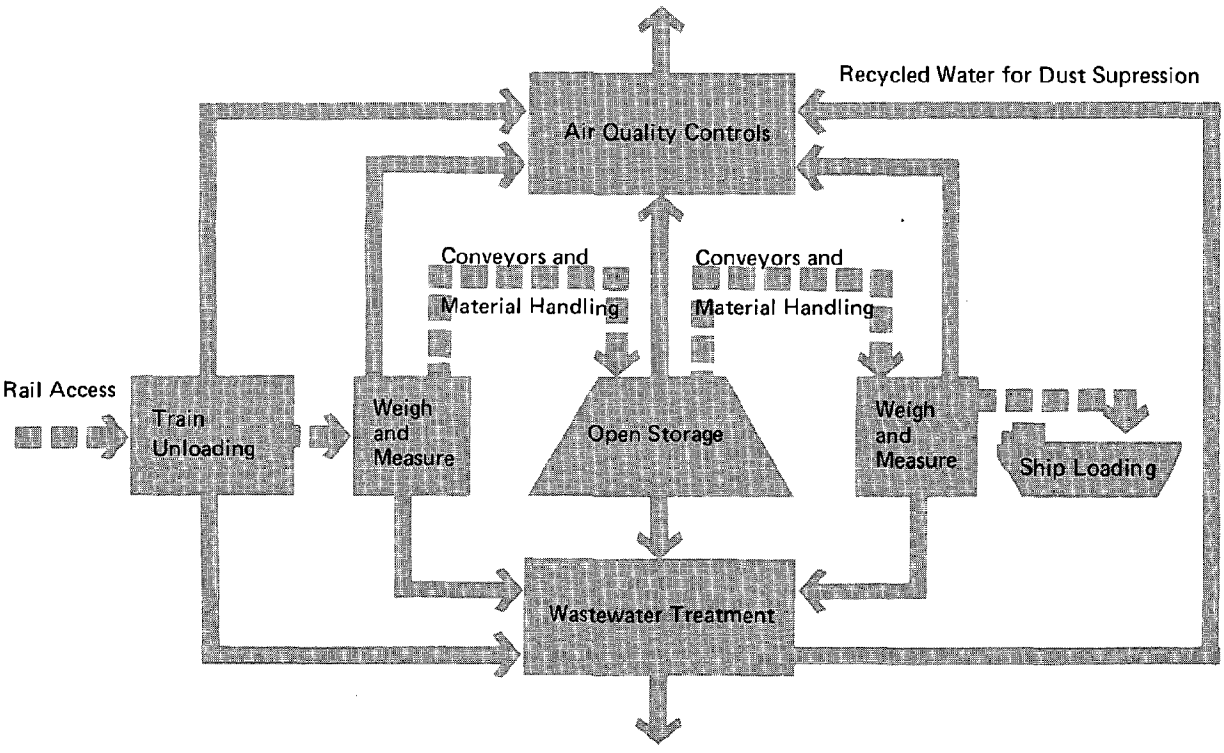
Facility Requirements

In basic terms, a coal port is a facility for moving coal from a rail train (or other incoming mode of transportation) to a bulk cargo ship for transportation overseas. For terminals now being planned in the northwest, this transfer process will be accomplished through the use of seven basic elements (illustrated in Figure 1):

1. An incoming rail line from the source of supply
2. A train unloading system
3. A weighing and sampling system at the loading and unloading points
4. A conveying system to move coal from the unloader to the stockpiles and from the stockpiles to the ship
5. A coal stockpile storage area
6. A berth or dock for ship loading
7. A waterway linking the facility to ocean shipping lanes

FIGURE 1

COAL PORT FACILITY COMPONENTS



In order to describe the impacts a coal port terminal can have on the surroundings and how these impacts might be mitigated, it is necessary to make a number of assumptions about the design of a typical coal port terminal. Two basic coal port alternatives encompass these assumptions: (1) the small port configuration (Figure 2) serves shallow-draft ships and handles generally fewer than 10 million tons of coal per year; and (2) the large port configuration (Figure 3) combines the elements of deep-draft accommodation, a long loading conveyor pier (required to reach deep water) and an annual throughput capacity in excess of 10 million tons of coal.

FIGURE 2

SMALL PORT CONFIGURATION

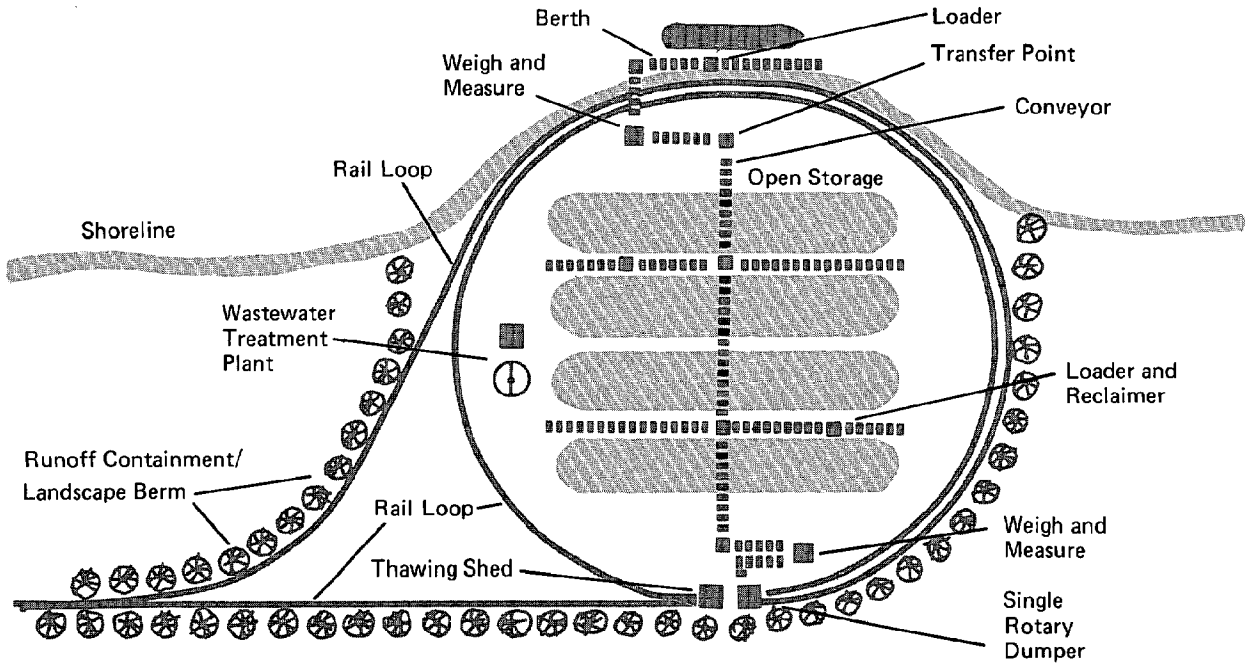
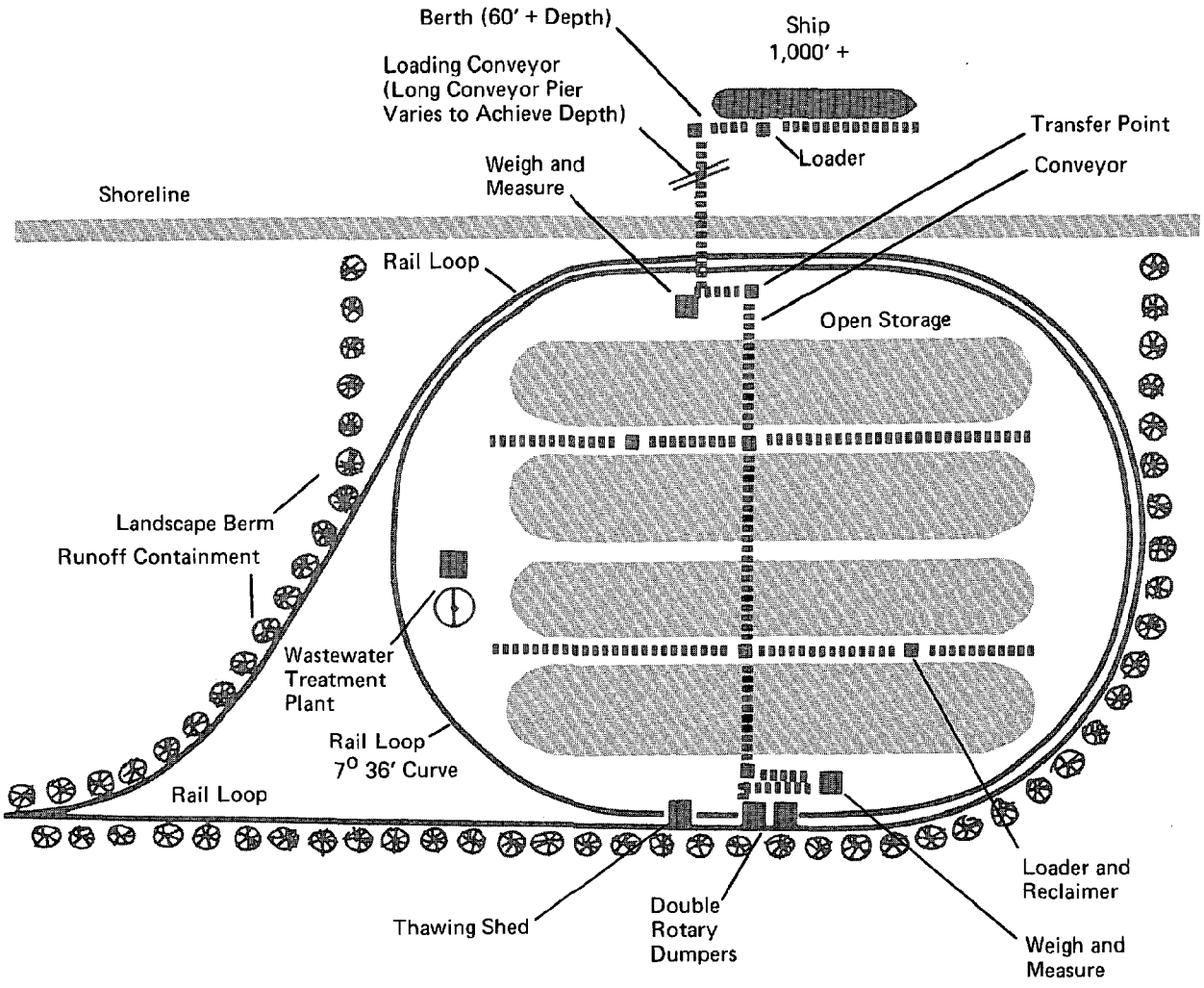


FIGURE 3

LARGE PORT CONFIGURATION



Transportation Modes and Routes

Railroads will probably provide the major transportation link between coal mines in the Rocky Mountain states and northwest ports. Although barge transport and slurry pipelines are being considered for the future, rail transport is the major focus of port planning at the present time.

Rail transportation of coal through the state of Washington will be via the lines of the Burlington Northern and Union Pacific Railroads. Although some alternate and overflow lines exist, the major routes for coal transport include:

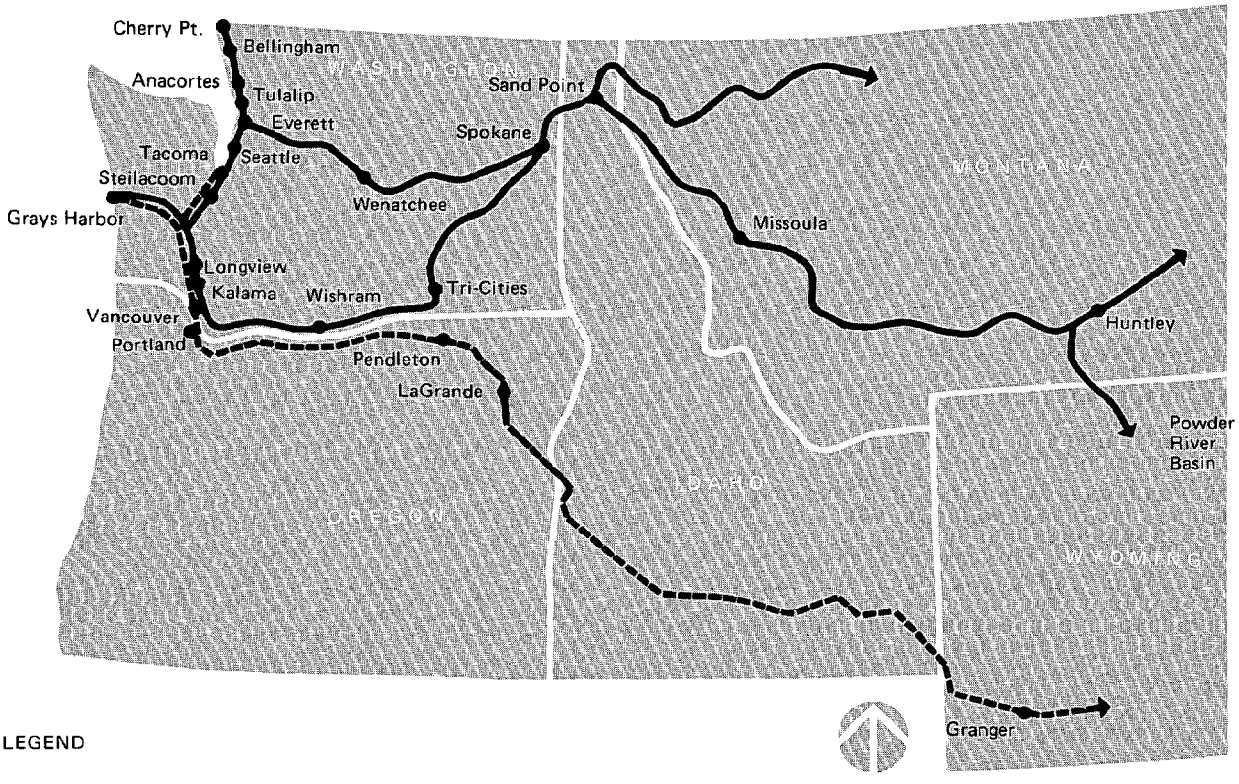
The Stevens Pass line via Wenatchee to Everett, which is the primary route for traffic destined for stops north of Tacoma.

The Columbia River line via Tri-Cities to Vancouver, which carries rail traffic destined for sites south of Tacoma.

These routes are illustrated in Figure 4.

FIGURE 4

RAIL TRANSPORT ROUTES TO NW PORTS



Potential Coal Port Areas

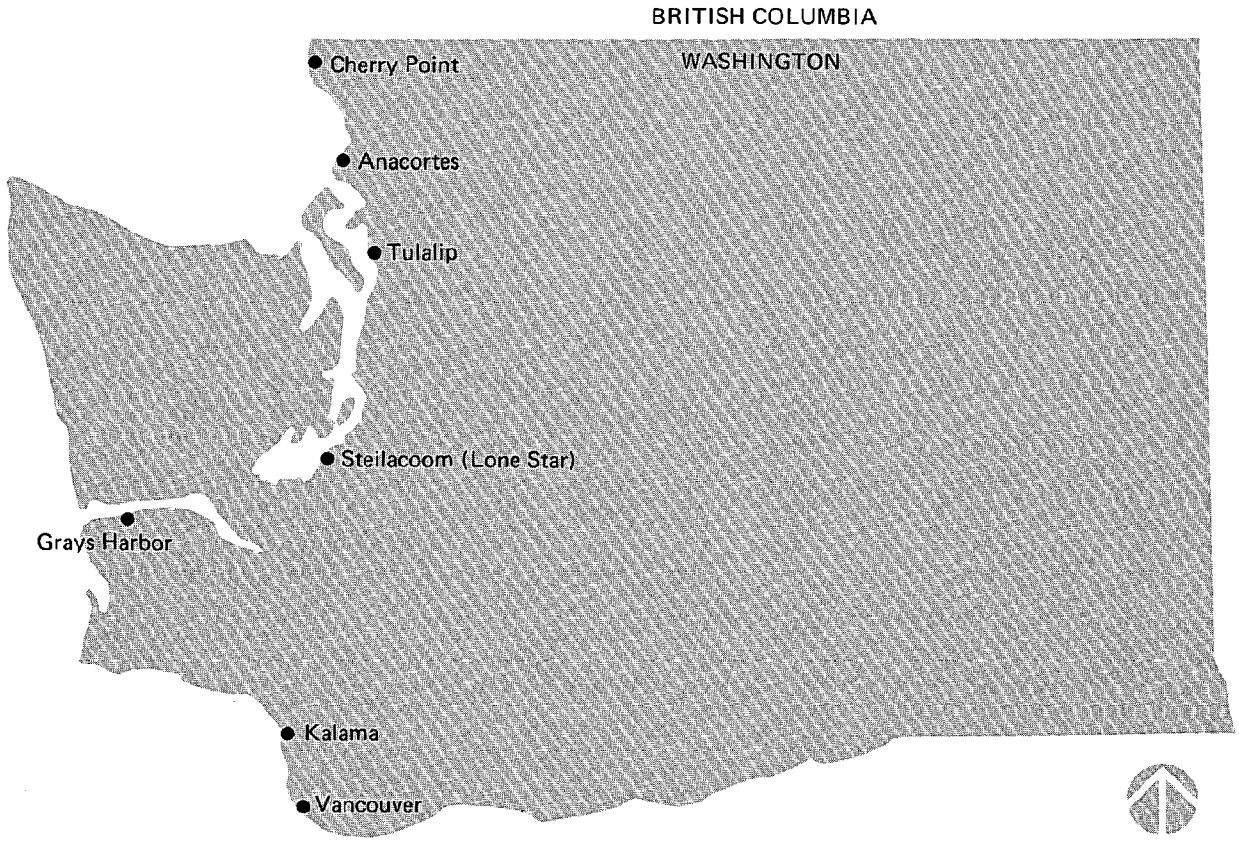
Specific port areas around the state have expressed a strong interest in developing coal export facilities. They include Cherry Point, Anacortes, Tulalip, Steilacoom (Lone Star), Grays Harbor, Kalama and Vancouver (Figure 5). Each of these locations satisfies, in some fashion, the basic industry needs which include:

1. Access to major rail lines.
2. Sufficient land area to accommodate coal stockpiles and specialized equipment.
3. Access to waters navigable by large bulk cargo ships.

However, market demand will be able to support only a few of these proposed coal ports.

FIGURE 5

LOCATIONS OF SPECIFIC POTENTIAL COAL PORTS



Environmental Issues

Any location being considered as a possible site for a coal transshipment port faces an array of potential environmental hazards which must be studied and planned for in advance if their impact is to be limited.

Potential impact issues are those aspects of the physical, biological and socio-economic environments which potentially could be directly or indirectly affected by the development of a coal port facility. Table 4 presents a synoptic breakdown of these potential issues organized into a checklist similar to that specified in the Washington State Environmental Policy Act (SEPA). The impact issues which it presents can be either of major or minor concern depending upon the character of a specific site. However, this checklist does provide a guide to environmental concerns which should be addressed in a detailed impact statement or assessment. The following text discusses these concerns.

Earth

Excavation and development at a site has the direct effect of changing the area's topography and compacting local soils. Indirect impacts can result from modifications of established runoff patterns in this area. In addition, pier structures across shorelines can change depositional patterns by interrupting the transport of sediments along a beach.

Air

The types of emission sources associated with a coal facility are fugitive in nature, similar to road and agricultural windblown dusts. The coal handling activities that will be potential

TABLE 4

Checklist Model of Potential Impacts

Earth

Changes to local topography
Surface compaction
Alteration of sediment transport along shoreline

Air

Elevated dust emissions
Emissions from ships, trains and other vehicles

Water

Modification of hydrologic regimes
Elevated levels of runoff
Degradation of adjacent surface waters by windblown dust
Increased turbidity due to dredging and dredge disposal

Flora and Fauna

Degradation of adjacent wetland habitat
Degradation of adjacent aquatic habitat
Degradation of adjacent terrestrial habitat
Disruption of corridors and fish migratory pathways
Rare or endangered species impacts

Other

Noise pollution
Light and glare generation
Alteration of land use designations
Potential for onsite accidents
Potential for ship accidents
Traffic congestion at grade crossings
Increased demand for public services
Increased demand for utilities
Aesthetic impact
Disruption of recreational/commercial fishing
Disruption of general recreational activities
Archaeological/historical resource impacts
Competing uses for land and shoreline

sources of particulate emissions include: railcar unloading, conveyor belts, conveyor transfer points, stackers and reclaimers, shiploading points, and the storage piles. There will be secondary emissions (as products of combustion) associated with the facility from the exhausts of ships, trains, and vehicular equipment on site. Table 5 lists some of the pollutants associated with coal dust.

Left unchecked, coal dust will settle to the ground within a few miles radius of a site. The pollutants associated with coal dust could then contaminate nearby soils and water bodies. For this reason, dust control devices are a vital design component of a typical coal port facility.

Water

Development of a coal port facility would probably modify existing patterns of surface water movement in an area. The major portion of a coal port site would be covered by a relatively impermeable working surface which could be expected to raise the runoff coefficient for the site area. Surface water and runoff would tend to move across the surface of facility working areas, accumulating in a system of ditches leading to a stormwater treatment system consisting of a series of settling ponds and several stages of treatment processes. After treatment, this water typically would be recycled for dust suppression spraying of the coal piles. Excess treated runoff would probably be discharged to local receiving waters. Potential pollutant levels in coal pile runoff are listed in Table 6.

TABLE 5

Potential Pollutant Mass Concentration in Fugitive Coal Dust Emissions

Pollutant	Mass Concentration (parts per million by weight)
Aluminum	8
Arsenic	7
Barium	65
Calcium	8
Cadmium	4
Chloride	160
Cobalt	9
Chromium	45
Cesium	2
Copper	30
Lead	7
Manganese	45
Potassium	2
Sodium	250
Iron	4

TABLE 6

Expected Pollutant Concentrations in Coal Pile Runoff

Pollutant	Concentration (mg/l)
Total Solids	500 to 3,000
Total Dissolved Solids	500 to 2,000
Total Suspended Solids	5 to 100
Total Hardness ($CaCO_3$)	300 to 1,200
Alkalinity ($CaCO_3$)	100 to 600
Bicarbonate	100 to 160
Sodium	20 to 200
Boron	0.7 to 0.8
Potassium	5 to 30
Calcium	120 to 240
Sulfate	100 to 1,000
Chloride	2 to 12
Fluoride	0.5 to 1.0
Silica	1.0 to 20.0
Manganese	30 to 150
Copper	0.1 to 1.0
Zinc	0.060 to 0.020
Aluminum	0.0 to 0.03
Lead	0.0 to 0.1
Total Iron	0.09 to 0.90
Ferrous Iron	0.0 to 0.5
Nitrate	0.3 to 2.3
TKN	0.7 to 3.0
Total Phosphate	0.4 to 1.8
Ammonia	0.4 to 1.8
BOD	1.0 to 3.0
COD	9 to 70
pH	6.0 to 8.3
Specific Conductivity	30 to 500*
Dust Suppressants	Unknown

*Micro-ohms per cm

Effective runoff treatment, an essential feature of coal port design, reduces these pollutants to acceptable levels established by the Environmental Protection Agency.

Fugitive coal dust emissions from exposed coal piles and from ship loading operations will contribute to water quality degradation in the area of a coal port development. Specific amounts of fugitive coal dust to be expected cannot be estimated until a determination is made regarding the "best available control technology" to be incorporated into a specific facility design. This determination would be made during the permitting process administered by the local air pollution control authority.

Dredging activities associated with coal port development temporarily increase turbidity in the adjacent navigable waters. Dredging and dredge disposal may be required in areas away from the port site area in order to accommodate coal ship operations. Under these circumstances turbidity effects could be widespread. Timing of dredging activities to avoid major fish runs is an essential part of coal port planning.

Flora and Fauna

When physical aspects of a particular ecosystem are modified, biological parameters also change. Generally, the most far-reaching change is habitat removal and modification. Relationships between organisms and the physical environment which have evolved over many years change and cause new ecosystems to emerge that often are not as complex as the natural systems which were replaced. A loss of complexity in an ecosystem results in a decrease in the types of plants and animals inhabiting a particular area.

Habitat areas of particular concern include:

Productive wetlands

Areas of diverse vegetative stands

Agricultural lands

Habitats supporting rare or endangered species

Unique and critical habitat areas

Other potential impact issues include creation of barriers to natural corridors of fish and wildlife movement and the issue of a ship's wake stranding juvenile fish on river shorelines.

Noise

Noise levels near a coal port will be increased due to:

Increased railroad traffic

Railroad car unloading

Coal handling and transfer operations

Ship loading operations

Light and Glare

A typical coal port facility will be equipped with lights for nighttime operation. This increased light level could lead to some disruption of adjacent residential areas and habitats.

Land Use

Site selection for a prospective coal facility should seek to comply with local comprehensive land use plans, zoning and shoreline management master programs. Where this is not possible, variances to existing land use designations may be required. Such variance requirements could have a variety of impacts depending upon adjacent land uses, agency concern and public receptiveness.

Natural Resources

Fuel requirements for ship and train movements will result in the consumption of nonrenew-

able fossil fuels. In addition, the commitment of upland and shoreline land resources to this type of industrial use may be viewed as basically irreversible.

Risk of Explosion or Hazardous Emissions

Some risk of accidental fuel spills could be present both during the receiving of incoming fuel supplies as well as during refueling activities for ships at port. Various permitting and regulatory authorities, however, require environmental protection plans that will minimize spills or other potential harmful discharges into a river or shoreline.

Some risk of coal dust explosions in confined spaces and spontaneous coal pile fires does exist.

Population and Housing

Based upon projections for coal ports proposed in the northwest, the creation of new jobs resulting in local population increases should not be a major impact. Given the projected level of facility employment, housing impacts are not anticipated to be a major issue.

Transportation

Employee and operational traffic generated at a site is not expected to be a major impact issue.

Waterborne commerce and other traffic (including recreational and commercial fishing boats) could present some potential congestion and maneuverability problems depending upon the configuration of particular harbors and waterways and the number of other large ships operating in the area.

Coal probably will be delivered to local port facilities in unit trains of 80 to 110 cars, each car containing approximately 100 tons of coal. The length of a typical train is estimated at 6,000 feet. It is assumed that each train will bring approximately 10,000 tons to the site. For a 15 million ton-per-year site, this translates into approximately four or five round trips per day. This volume of traffic increase will present a variety of different impacts to communities along major rail transport routes, as well as to the coal port community.

Public Services, Energy Usage, Utilities

Major impacts are not anticipated.

Human Health

No major or unusual human health impacts are anticipated for people living near a coal port facility. The potential does exist, however, for workers at the site to develop health problems.

Aesthetics

A highly visible coal facility may result in significant aesthetic impacts, whether viewed from the land or the water.

Recreation

Water associated components of a coal facility may present severe impacts to recreational fishing and other water uses in some areas, particularly where extensive pier or piling structures are required.

Archaeological/Historical

As with any major project, any suspected archaeological or historical resources in the development area must be surveyed and accounted for.

Competing Uses

Competing potential uses for a specific site area may require a separation of facility components. For instance, unloading and storage operations which are not water dependent may

have to be located well inland from the coal loading and ship berthing operations to allow more room for other competing facilities to utilize limited shoreline land resources.

Impact Avoidance Measures

To minimize the potential consequences of constructing a coal transshipment facility, specific steps can be taken in order to avoid substantive impacts on the area.

Impact avoidance measures include all activities and actions which are intended to eliminate, reduce or provide compensation for potential environmental impacts. Impact avoidance measures can be subdivided into three basic categories:

1. **Siting Measures**
2. **Design and operation measures**
3. **Mitigation measures**

Specific avoidance measures within each of these categories are listed in Table 7. How these impact avoidance measures apply to specific potential impacts is illustrated in the matrix presented in Figure 6.

Environmental damage can be greatly minimized by locating coal storage facilities in areas previously disturbed and of low habitat quality such as in areas that are already industrialized.

TABLE 7

Impact Avoidance Measures

Siting Measures

Site in industrial area
Avoid areas which would impact wetlands or other critical habitats
Restrict shoreline siting to water-dependent facility components
Site in areas previously disturbed or with low habitat quality
Avoid noise-sensitive populations
Avoid floodways

Design and Operation Measures

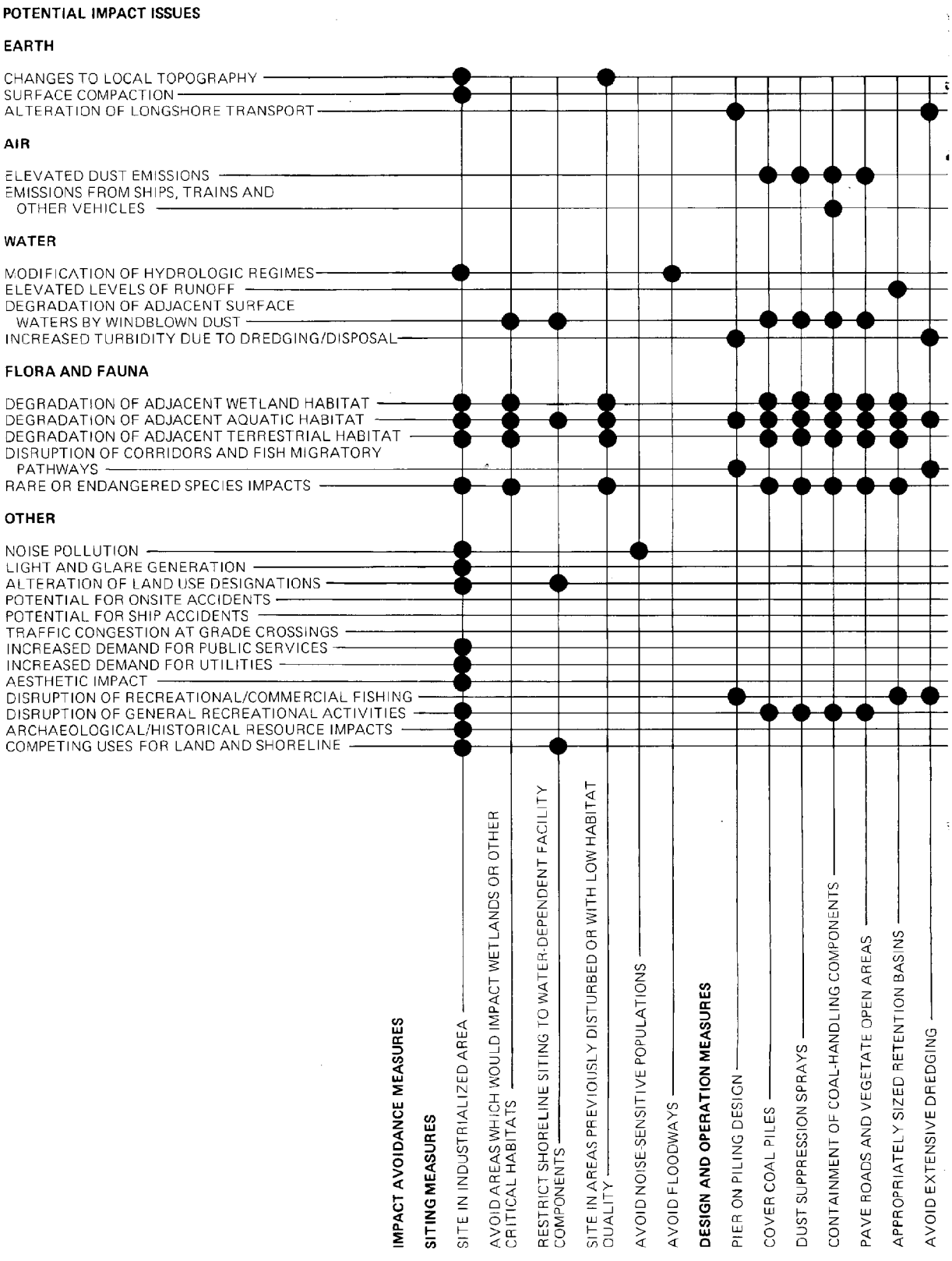
Pier on piling design
Cover coal piles
Dust suppression sprays
Containment of coal-handling components
Pave roads and vegetate open areas
Appropriately sized retention basins
Avoid extensive dredging
Minimize component placement along shorelines and in shallow water
Configuration avoidance of important habitat areas
Perimeter berm/vegetative buffers
Daytime scheduling of noisy operations
Directed lighting to minimize glare
Use of glass refractorless luminaires
Allowance of public access to site property shoreline
Onsite safety measures
Installation of aids to navigation
Schedule trains for off-peak traffic hours
Construct overpasses
Break up unit trains to minimize crossing delays in congested areas
Road or track rerouting
Onsite firefighting equipment
Onsite potable water supply
Onsite sewage treatment
Allow fishing near piers where possible
Allow recreational rights-of-way where possible
Site survey by state-approved professional archaeologist/historian

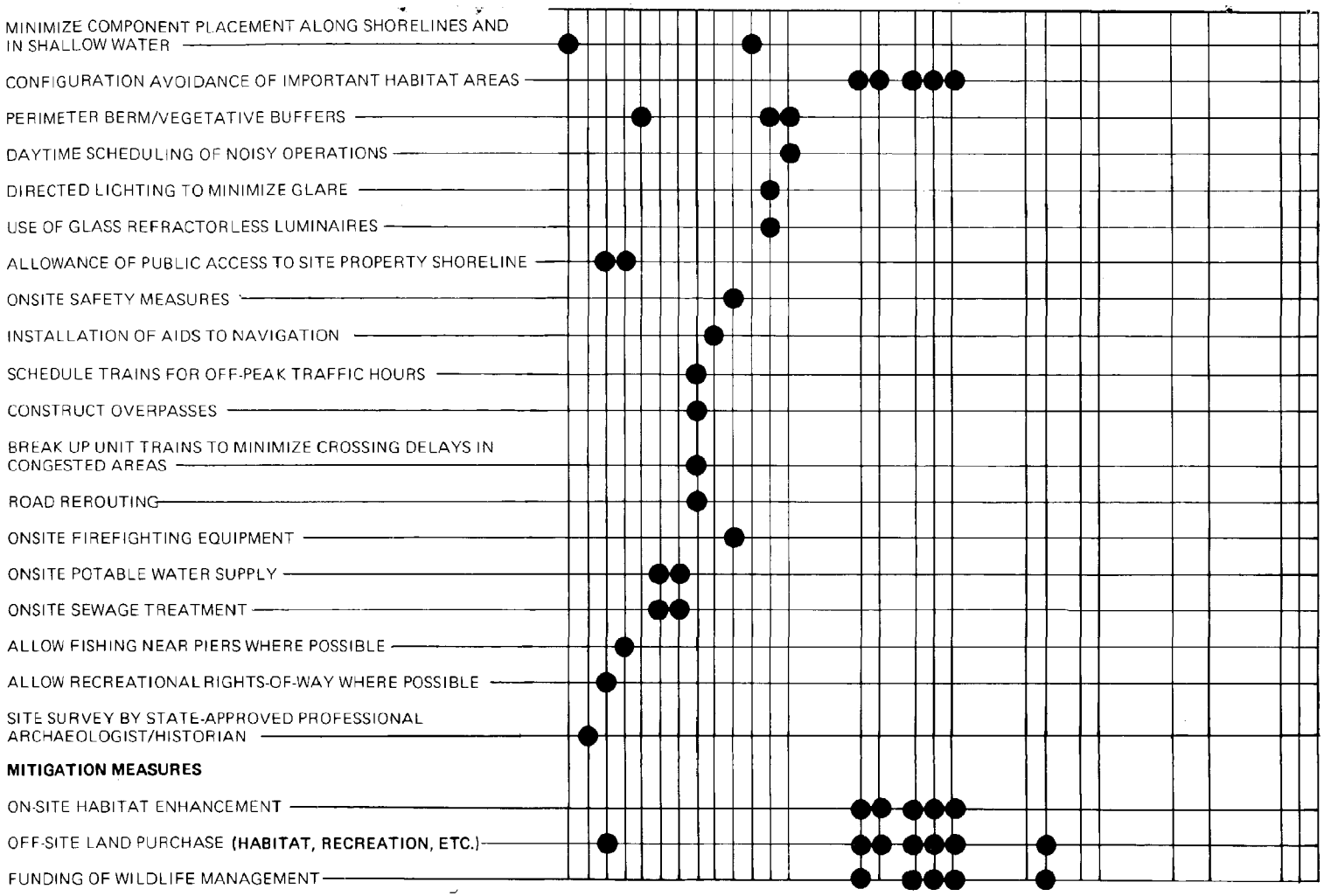
Mitigation Measures

Onsite habitat enhancement
Offsite land purchase (habitat, recreation, etc.)
Funding of wildlife management

FIGURE 6

POTENTIAL IMPACT ISSUES/IMPACT AVOIDANCE MEASURES MATRIX




MINIMIZE COMPONENT PLACEMENT ALONG SHORELINES AND IN SHALLOW WATER
CONFIGURATION AVOIDANCE OF IMPORTANT HABITAT AREAS
PERIMETER BERM/VEGETATIVE BUFFERS
DAYTIME SCHEDULING OF NOISY OPERATIONS
DIRECTED LIGHTING TO MINIMIZE GLARE
USE OF GLASS REFRACTORLESS LUMINAIRES
ALLOWANCE OF PUBLIC ACCESS TO SITE PROPERTY SHORELINE
ONSITE SAFETY MEASURES
INSTALLATION OF AIDS TO NAVIGATION
SCHEDULE TRAINS FOR OFF-PEAK TRAFFIC HOURS
CONSTRUCT OVERPASSES
BREAK UP UNIT TRAINS TO MINIMIZE CROSSING DELAYS IN CONGESTED AREAS
ROAD REROUTING
ONSITE FIREFIGHTING EQUIPMENT
ONSITE POTABLE WATER SUPPLY
ONSITE SEWAGE TREATMENT
ALLOW FISHING NEAR PIERS WHERE POSSIBLE
ALLOW RECREATIONAL RIGHTS-OF-WAY WHERE POSSIBLE
SITE SURVEY BY STATE-APPROVED PROFESSIONAL ARCHAEOLOGIST/HISTORIAN
MITIGATION MEASURES
ON-SITE HABITAT ENHANCEMENT
OFF-SITE LAND PURCHASE (HABITAT, RECREATION, ETC.)
FUNDING OF WILDLIFE MANAGEMENT

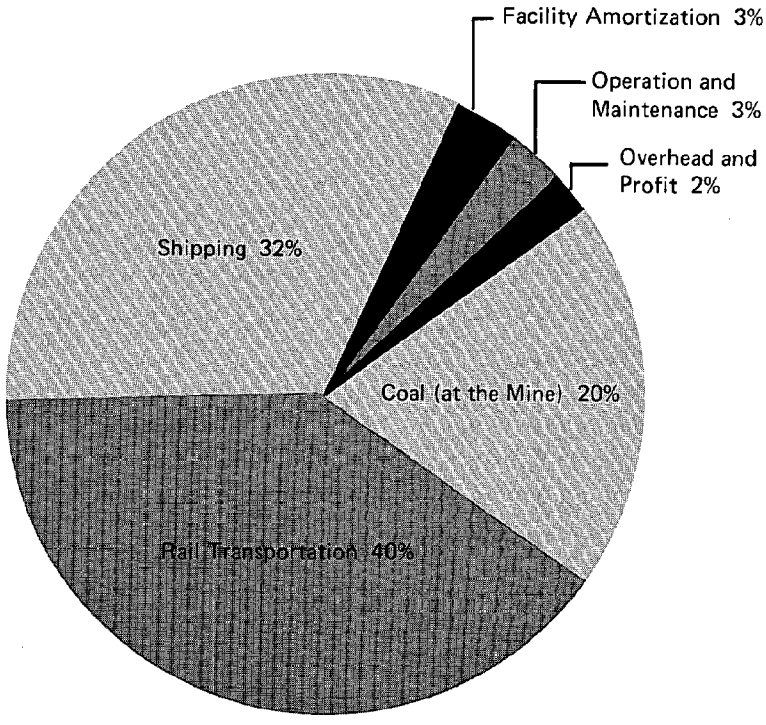
Costs of Impact Avoidance

The total cost per ton of coal delivered to an Asian port (from the northwest) through a typical 10-million-ton-per-year facility is estimated to be around $50 per ton. Figure 7 illustrates the components which make up that cost. As shown, transportation costs (rail and shipping) make up almost 75 percent of the total cost of coal. In contrast, actual facility costs are a very small portion of the total, at 6 percent. These relative costs suggest that impact avoidance measures related to the transportation of coal are apt to have more impact on the total cost of coal than those which affect the actual facility.

Table 8 summarizes approximate impact avoidance costs, including standard environmental protection devices already included in the capital costs of a facility. As shown, most impact avoidance measures have a very small effect (less than 1 percent) on the

FIGURE 7

TOTAL COST OF COAL



total cost of coal. However, restrictions of facility operations and the enclosure of coal piles could increase the cost of coal to such a degree (up to 3 percent) as to significantly limit the financial feasibility of a proposed coal port facility. Some alternative impact avoidance measures are also indicated in the table.

TABLE 8

Summary of Impact Avoidance Costs
(1982 dollars)

Description	Approximate Annual Cost	Cost per Ton of Coal*	% of Total Cost of Coal**	Alternative Measures
Standard environmental protection devices	$1,000,000	$0.10	less than 1%	None
Habitat management	340,000	0.03	less than 1%	Site location
Enclosure of coal piles	9,000,000	0.90	2%	Site location State-of-the-art environmental protection devices
Restriction of operating hours	15,550,000	1.56	3%	Site location Noise mitigation
Replacement of recreational areas	40,000	0.01	less than 1%	Site location
Commercial fishing management	250,000	0.03	less than 1%	Site location
Railroad grade separation	800,000	0.08	less than 1%	Site location Alternative routing Signalization
Signalization	200,000	0.02	less than 1%	Site location

* Assumed terminal capacity is 10 million tons per year.
** Total cost of coal is $50.00 per ton.

Source: WK&A

Conclusion

This project included the following study elements:

Identification of typical coal facility components

Identification of typical coal facility operations

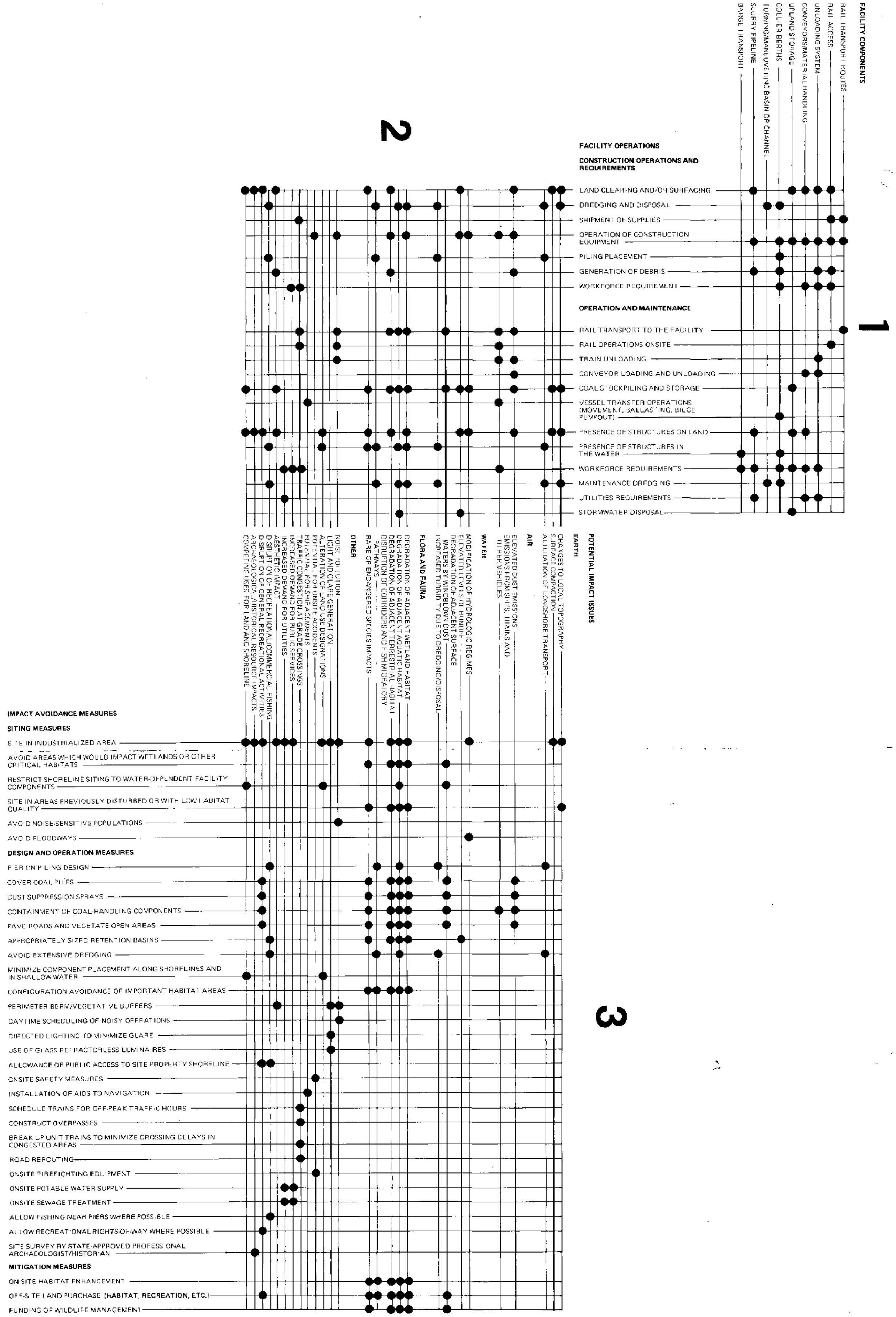
A projection of potential impacts resulting from facility construction and operation

Identification of practical impact avoidance measures

The step matrix presented in Figure 8 provides an overview of the relationship between these study elements. Specific facility components are listed and matched up by dots in Matrix 1 to facility operations necessary for the construction, operation and maintenance of a coal export facility. Matrix 2 shows how the different facility operations give rise to specific issues of potential environmental impact. These potential impact issues are matched in Matrix 3 to an array of applicable impact avoidance measures. The purpose of this step matrix is not only to illustrate the cause and effect relationship between project implementation and subsequent ecological and social impacts and impact avoidance measures but also to help identify for the decision-maker those specific resources and environmental factors of most concern with respect to a possible development site. Alternatively, the effect of specific impact avoidance measures on facility operations and components also can be determined.

It is the conclusion of this study that environmentally acceptable coal export facilities can be developed in the state of Washington within the context of an anticipated market share for the Pacific northwest. Although the number and location of these facilities will depend upon the nature of specific signed contracts, avoiding unacceptable environmental impacts can be accomplished through prudent siting of facilities, effective design and operational measures and direct mitigation activities.

FIGURE 8
SUMMARY MATRIX



Acknowledgements

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